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DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

Road Accident Returns

FOR nearly three years a weekly record of road accidents in Great Britain has been issued by the Ministry of Transport with the co-operation of the police, and has served as a reminder to all road users of the need for unremitting care and vigilance. Publication week by week of figures may tend by its very regularity to fail to achieve its object, unless such detail is given as will invest this information with more precise significance. For this reason, and also in order that more detailed information may be given than is practicable in a weekly return, the Minister of Transport decided that in 1937 road accident figures for Great Britain should be issued monthly instead of weekly, and accordingly the last weekly return was for the seven days ended January 2, which we published on page 75 of our January 8 issue. The first of the new monthly statements, which will be issued in February, will show the numbers of persons killed, seriously injured, and slightly injured during the previous month. Separate figures will be given for every class of road user, and pedestrians and pedal cyclists will be sub-divided into groups of under and over 15 years of age. It is expected that the latter information will be particularly useful in connection with the intensified efforts now being made to promote the safety of children. The statement will also present for the first time separate figures for roads subject to a speed limit and for unrestricted roads.

* * * *

L.M.S.R. Stations as Social Centres

Last week-end the popular press paid a considerable amount of attention to the intention of the L.M.S.R. to transform certain of its important provincial stations into social centres, mainly by using the valuable sites above and around the stations for cinemas, exhibition halls, shops, and so forth. The idea is, of course, an extension of the policy successfully pursued for years past of making the railway hotel a centre of many social and business activities. Such plans have been under consideration for some time, and L.M.S.R. officials have visited the United States with the object of examining the latest practice there. The practical difficulties of undertaking specific schemes are considerable, and it is too early to say that any decision has been taken. It is probable, however, that important changes will be made in the use of such valuable and central sites as those occupied by Lime Street station (Liverpool), New Street station (Birmingham), and London Road station (Manchester). Especially in view of the fact that such stations as these are not of modern design, and were planned when traffic was far smaller than at present, rebuilding and remodelling are impending necessities, and such additional uses of the station sites as are envisaged by these plans should not only improve the amenities of the station precincts, but also assist in bearing the heavy cost of such reconstruction.

* * * *

The Week's Traffics

At this time a year ago the four group railways were showing substantial increases in coal traffics mainly because of uncertainty as to the labour position, and at January 17, 1936, the increase in coal receipts for the four companies aggregated £179,000, or about 10 per cent. This accounts entirely for the £69,000 decrease to date shown by the four companies in 1937. In the corresponding week of 1936 the L.M.S.R. had an increase of £8,000 in merchandise and the L.N.E.R. one of £12,000, but passenger train traffics were slightly down except on the L.N.E.R. On the passenger side this year traffics are up £42,000, or 2·08 per cent., for the four companies, and merchandise receipts show a net increase of £11,500, or 0·57 per cent.

	2nd Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 6,000	+ 24,000	− 16,000	+ 14,000	− 25,000	− 1·11
L.N.E.R. ..	+ 7,000	− 2,000	− 13,000	− 8,000	− 50,000	− 2·97
G.W.R. ..	+ 4,000	+ 6,000	− 7,000	+ 3,000	+ 6,000	+ 0·65
S.R. ..	+ 11,000	− 2,500	− 6,500	+ 2,000	—	—

Irish railway traffics in the aggregate to January 15, 1937, show decreases of £581 on the Belfast & County Down, £2,900 on the Great Northern, and £827 on the Great Southern.

* * * *

Bengal & North Western Railway

Gross earnings from the 1,305 miles of metre gauge line of the Bengal & North Western Railway Company and from the 795 miles of Tirhut State Railway which the company works showed in the year ended September 30, 1936, an increase of Rs. 23,21,408 over the previous year. Working expenses were Rs. 4,51,638 lower, and net earnings improved by Rs. 27,73,046. The increase of 575,539 in the number of passengers was mainly in the third class, and the principal advances in goods tonnage were under sugar cane and sugar and grain and pulses, against decreases in coal and manufactured cotton. Less relaying of lines and repairs to bridges, &c., accounted for the decrease of Rs. 4,64,316 under maintenance of

way and works, and locomotive expenses decreased by Rs. 1,05,437 because of heavier renewals in the previous year.

	1935–36	1934–35
Passengers	30,928,959	30,353,420
General merchandise, tons	5,008,123	4,202,858
Mean mileage	2,110	2,113
Train-miles	9,055,293	8,852,109
Operating ratio, per cent.	43·65	47·87
	Rs.	Rs.
Coaching receipts	1,45,58,792	1,43,97,537
Goods traffic receipts	2,15,79,700	1,98,30,357
Total earnings	3,70,19,162	3,46,97,754
Working expenses	1,61,58,756	1,66,10,394
Net earnings	2,08,60,406	1,80,87,360

The company's share of net earnings was Rs. 1,20,02,508 realising £905,454, as compared with Rs. 1,05,85,331 and £797,793 respectively for 1934-35. Stockholders receive 18 per cent., as compared with 16 per cent. for the five previous years.

* * * *

Jamaica Government Railway

The damage to banana cultivations by storms in September and October, 1935, had a serious effect on the earnings of the Jamaica Government Railway for the year ended March 31, 1936. For the first half of the year the net receipts had been £37,665, but the loss of so many bananas affected traffic generally in the later months, and road motor competition was also more intense. Reduced earnings were obtained from passengers, general merchandise, canes, and coconuts, although in other directions there were appreciable increases.

	1935-36	1934-35
Passengers	427,407	494,905
Goods, tons	274,900	300,865
Train-miles	409,434	434,253
Operating ratio, per cent.	102·45	89·52
	£	£
Coaching receipts	33,975	39,718
Goods traffic receipts	201,685	230,449
Gross receipts	264,249	293,767
Expenditure, including renewals	270,744	262,996
Working profit (+) or loss (−)	−6,495	+30,771

Total debt charges on the railway during the year under review were £90,565, and the amount to be met from general revenue was £97,060. The length of line in operation remained at 210 miles on the standard gauge.

* * * *

The Private Stationmaster

When 111 years ago the Stockton & Darlington Railway began operation the engine drivers were not actually a part of the company's staff, but were bound by contract at a ¼d. per ton-mile, out of which they had to pay their fireman, buy coal, oil, tallow, and any other necessary supplies, and also oil and grease for the wagons in their trains. A similar method of staffing stations, mainly on secondary lines, still enjoys a good deal of popularity, although contract enginemen have long since disappeared. In fact, most of the European state-owned railways appear to have private agents or managers at many of the small stations. For instance, on the Danish State Railways there are 45 stations staffed wholly by individuals under contract, and 100 stations partly staffed by such persons. On the extensive 950-mm. gauge system in Sicily most of the *capo del stazione* are private persons, but at certain key stations, from which the traffic is controlled, the whole of the staff is on the permanent list of the railway. Frequently there is keen competition for these posts, but in Austria, Germany, Czechoslovakia, and elsewhere retired railway servants are given preference. Station managers in Denmark must undergo an examination, but nevertheless train crossings are not usually permitted at their stations, and they may operate signals only in emergency. The Polish State Railways have adopted the expedient of appointing station agents at places where decrease of traffic would otherwise have meant the closing of the station, in the hope that the competitive nature of the post will make the agent exert himself to get traffic.

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Berlin to Rome in 22½ hours

In Europe today it is possible considerably to curtail the duration of certain long-distance journeys by the use, where these are available, of high-speed railcars. For example, for some time past it has been open to the traveller from Berlin to North Italy to take the Fliegende Münchener railcar service at 5.6 p.m. from Berlin to Munich, and by arrival there at 11.42 p.m. just to catch at 11.50 p.m. the 1.40 p.m. train from Berlin for Rome by Innsbruck, the Brenner, and Verona. Shortly, however, the new Italian railcar service from Bolzano to Bologna will be available, and it will then be practicable for the passenger in a hurry, having rested in his sleeping berth until 7 in the morning, to change at 7.6 a.m., into the Italian railcar at Trento, leaving there at 7.19 a.m., and so to overtake at Bologna the 10 a.m. express for Rome. Thus by the use of two railcar services conveniently timed for the purpose, and with comfortable sleeping accommodation sandwiched in between them, the rail journey from Berlin to Rome is brought down to the hitherto unprecedented time of 22 hr. 14 min. from the 28 hr. taken by the through carriages, and merely at the expense of three changes of train *en route*. The overall speed for the 1,031 miles including the crossing of two frontiers and the lengthy traverse of the Alps, is raised from 36·8 to 46·3 m.p.h. The fact that these connections are advertised is a tribute to the very high standard of punctuality that prevails on the Continent. An illustration of the Fliegende Münchener appears on page 149.

* * * *

Why Not Good Platform Indicators?

The extension of electric services round London has certainly brought increased convenience to the public, but the improvement of stations and their equipment has not, we feel, received the attention it deserves. An unsatisfactory feature of the working at many stations, in some cases even important junctions, is the complete absence of suitable platform indicators, to show where trains are going and where they are stopping; such as are to be found on the Underground. Regular travellers may understand—if officially not supposed to regard them—the train headcodes, but even so mistakes are easily made. We recently entered a train, the headcode of which we knew quite well, only to be taken six stations non-stop, at considerable inconvenience. There was nothing on the train to warn one of the fact, and the porter's announcement was not made until the train was passing him, when it was drowned by the noise. Considering the amount of money spent on electrification itself, it seems a pity that the secondary facilities, which mean so much to passengers' convenience, receive such scant consideration. There is one thing that might, in any case be done; announcements might be called out while they can be heard. That would cost nothing.

* * * *

Increasing the Power and Efficiency of Old Engines

If but little in the way of locomotive building has been done in France during the past decade, the remarkable results that have attended the reconditioning of French locomotives, beginning with the now historic Chapelon

experiments on the Paris-Orleans, have put into the hands of the operating authorities of almost all the railways of France what might to all intents and purposes, be new engines of greatly increased power and efficiency. On page 145 of this issue details are given of a reconditioning experiment on the Nord with a locomotive of a type introduced in 1900—37 years ago—of which the performances so impressed British locomotive engineers that three similar engines were purchased by the Great Western Railway in 1903 and 1905 for comparative trials with standard G.W.R. locomotives. The modifications to this French 4-cylinder compound have been relatively slight, but are chiefly, it need hardly be said, in the realm of freer exhaust, with a chimney of larger diameter. The result has been to give the engine, on test runs, a drawbar h.p. as high as 1,420 at 75 m.p.h., and a greater power output at all speeds above 68 m.p.h. than much larger Pacific locomotives introduced in 1912. Such important trains as the non-stop Paris-Brussels North Star and Blue Bird Pullman expresses have been entrusted with entire success to No. 2659, the reconditioned Atlantic, and a schedule of 64·4 m.p.h. for the 193·1 miles has been bettered by 5 min. with a load of 289 tons. With 341 tons the 1 in 200 of Survilliers bank has been surmounted in its entirety at 68 to 71½ m.p.h.

* * * *

High Speed Uphill

One of the secrets of successful locomotive performance on the Silver Jubilee express of the L.N.E.R. is the great increase, as compared with other L.N.E.R. services, that has been effected in the speed of its uphill running, so that 1 in 200 grades are generally surmounted at speeds of 70 m.p.h. or thereabouts. Apart from specific slacks and the recovery from them, therefore, the speed of this train is normally kept between the limits of 70 and 90 m.p.h., with slight " tolerances " below or above, which suffices for the observance of a booking over 232·3 miles at 70·4 m.p.h. from start to stop. On page 153 of this issue is described a French journey, non-stop over 216·7 miles, in which far narrower limits of speed than this were maintained. Over the entire distance, except in acceleration from the start and recovery from three service slacks, with a train of 397 tons and in bad weather conditions, the rebuilt Paris-Orleans Pacific responsible was driven at a speed which never fell below 68½ m.p.h. nor exceeded the legal speed limit of 74½ m.p.h. From a study of the Flaman record taken from the locomotive, it would be impossible to detect where the rising or falling gradients begin or end; even up inclinations as steep as 1 in 200 speed was still maintained at about 70 m.p.h., despite a load nearly four times the weight of the locomotive. This run provides yet further evidence of the really amazing results of the application of the principles enunciated by M. Chapelon, and it is of interest that the run was performed wihout any assistance from streamlining.

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Reclaimed Material as Scrap

A correspondent writing in our American contemporary, the *Railway Mechanical Engineer*, draws attention to a matter of some importance in connection with the purchase by railways of reclaimed material. Since 1929, he says, large numbers of passenger cars have been retired, and the majority of them have been dismantled by contractors who sell back to the railways whatever material they wish. As a rule the stores departments of the railways furnish the contractors with lists showing what items they require, and then place this material in stock without knowing whether or not they are buying good material or scrap. Then when the mechanical department issues a requisition for a consignment, it is found in many cases that under the A.A.R. rules and specifications, the items furnished are in such a condition that they should have been scrapped. The repairs to these items would, it is stated, cost more than the new purchase price, to say nothing of the delay in returning the vehicles to service. The correspondent goes on to remark that on the majority of American railways it is possible to see large piles of coupler parts purchased in this manner, many of which should not and, indeed, would not have been bought had the proper gauges been used before the parts were removed from the couplers. He suggests, in conclusion, that if proper gauging and inspection were carried out at the time of purchase, the railways would not be carrying, as at present, a lot of scrap material in stock.

* * * *

The Use of Bronze in Welding

A statement recently issued regarding the use of bronze in welding locomotive parts, points out that this has certain well defined advantages. Piston heads, to the bearing faces of which a layer of bronze has been applied, will give, it is said, double the mileage of cast iron, cast steel or alloy heads. The usual practice is to apply new solid heads or bull rings as required and permit them to remain in service until the limit of wear is reached; they are then removed and built up with a layer of bronze on the lower one-third or half of the circumference, and at subsequent shoppings of the locomotive the old bronze is removed and a new layer applied. By this procedure the life of piston heads or bull rings is extended to equal the life of the locomotive, the purchase of new piston heads being practically eliminated. One of the later developments along the line of bronze welding is the application of hub liners to driving boxes, and the introduction of the large capacity welding blowpipe has made it possible to apply these heavy liners at less cost than is entailed by the old methods of casting the liner or of fixing it with studs. Locomotive cylinders whether of cast-iron or cast-steel must, it is stated, be very badly broken before repairs cannot be economically effected by the oxy-acetylene process, and it is furthermore contended that the time required for building up a pyrometer controlled furnace around the cylinder *in situ* and carrying out the welding operation without removing the cylinder from the frame, is no more than where the cylinder is removed for heating.

* * * *

P.L.M. Winter Sports Seasons

Among the numerous special facilities offered by the French railways to winter sports enthusiasts, there is this year an innovation from the P.L.M. in the shape of seasonal tickets between Paris and the Alps or Jura Mountains, available every week-end over periods of six months (thirty journeys) or three months (fifteen journeys). They are issued in all classes, and the cost of a first class six-month ticket is fr. 2,900 (less than £28 at the present rate of exchange). Thus, the first class traveller who uses his ticket regularly can make the lengthy return journey between Paris and the winter sports resorts for less than £1 a time. These new bargain rates cover not only travel out and home (visiting a different destination in the prescribed areas every time if desired), but transport between resorts in the same region, and the facility of returning from a station other than that travelled to on the outward journey. The same tickets are available on the Eastern Railways between Paris and the Vosges; on the Paris-Orleans between Paris and La Bourboule or Mont Dore; or to Bâle, Delle, and Vallorbe by the P.L.M.

Sir John Aspinall

WITH the death of Sir John A. F. Aspinall, whose career is recorded on page 147, there passes one of the most outstanding figures in British railway annals. He will, perhaps, be remembered by the majority as a locomotive engineer first and foremost, and one whose outlook in that sphere was progressive, with an inclination towards originality moderately exercised in accordance with circumstances. He ran Mr. H. A. Ivatt, the locomotive chief of the then Great Northern Railway, very close for the honour of first introducing the Atlantic type of locomotive to British railways, and produced what was at the time considered to be rather a startling design, having coupled wheels 7 ft. 3 in. diameter, inside, steam jacketed cylinders, and a very large boiler with its centre line pitched at nearly 9 ft. above the rails. Apart from the fact that these engines, the "1400" class of the Lancashire & Yorkshire Railway, were the only 4-4-2's to have the cylinders placed between instead of outside the frames they, or some of them, were noteworthy in respect of other features in their design. For instance, they were fitted with a special form of unit superheater located entirely within the smokebox, and with balanced backed slide valves specially designed to facilitate the escape of the exhaust steam.

Mr. Aspinall, as he then was—the honour of knighthood being conferred upon him in the year 1917—designed several other classes of engines for the L. & Y.R. on orthodox lines, all of which were remarkable for the simplicity of their layout, efficient working, and economy in maintenance. He was a strong advocate of standardisation and, on his appointment to the L. & Y.R., took in hand the task of reducing the number of engine types on that system. Thus in the locomotive field he played a worthy part and was, we believe, the first British railway locomotive engineer to bear the title of Chief Mechanical Engineer. His right to be regarded as an engineer of more than average versatility is upheld by the fact that his work in other spheres ranked on a basis of equality with what he achieved as a designer of locomotives. It was he who planned the Horwich works of the company, which, in addition to producing new locomotives and maintaining the existing engine stock in a proper state of repair, incorporated, when fully equipped, a steel plant and sections in which permanent way and signalling requirements were produced, in addition to such items as telegraph appliances, electrical plant, and hoisting machinery. He was also held responsible for the task of reorganising and equipping the company's docks and warehouses at Goole and elsewhere with new crane installations, and other transporting appliances used in loading and unloading ships and the movement of railway vehicles about the dock yards. We had an opportunity of visiting the Goole docks shortly after the scheme of improvement had been completed, and remember even now the very favourable impression then formed of the efficiency of all the arrangements carried out in accordance with Sir John Aspinall's designs and under his supervision.

He possessed one of those expansive minds that allow almost any problem associated with widely varying engineering undertakings to be faced with confidence, and also the ability to see things through to a favourable conclusion; so it is certain that had his position remained solely that of Chief Mechanical Engineer, a post which he occupied for 13 years, Sir John's many-sided qualities and abilities would never have been so fully and advantageously used as was made possible by his advancement to the position of General Manager of the L. & Y.R. This provided him with a much enlarged scope in which to exercise his pronounced organising abilities, and, when the opportunity came, made possible the fulfilment of many of the ideas he had long considered desirable. The papers he delivered at meetings of the Institution of Mechanical Engineers and to the International Railway Congress revealed him as one of the most profound students of railway engineering problems, and his contributions to literature on the subject have always been appreciated at their full value.

Notwithstanding his deafness, it has been the lot of few prominent men to enjoy a fuller or happier life. He took a dispassionate interest in every occurrence. Even when interned in Germany, where he was on vacation at the beginning of the war, he made careful notes of his experiences and contributed a most interesting and dispassionate letter to *The Times* on his return. We should say that he thoroughly enjoyed the whole of his twenty years' general managership of the Lancashire & Yorkshire Railway. In fact, he regarded "his railway" which he left in such a high state of efficiency, with the enthusiasm and affection of a hobbyist. A former colleague, since departed, wrote in an article in this paper at the time of Sir John's retirement: "Those who knew him, and worked with and for him, will miss his Monday morning pocket book full of notes and questions set down during the week-end reflections." Not infrequently we also on a Monday morning would receive a letter either criticising or commending some article or paragraph in our columns or suggesting a subject for a future article or an appointment to discuss some railway subject. In fact, from the time this paper came under its present editorship, thirty years ago, he took a keen and most helpful interest in THE RAILWAY GAZETTE. For example, it was at his suggestion that we published in 1928 the series of articles on steel sleepers.

* * * *

New South Wales Government Railways

A RETURN to normal conditions is indicated in the report of the New South Wales Government Railways for the financial year ended June 30, 1936, which has been sent to us by Mr. T. J. Hartigan, Commissioner for Railways. This report shows a considerable improvement on the satisfactory results obtained in the previous year. Total earnings increased by £950,882, or 5·94 per cent., whereas in working expenses there was an advance of only £282,412, or 2·44 per cent., so that net receipts from operation improved by £668,470, or 15·07 per cent., giving a return on capital of £3 11s. 6d. per cent., compared with £3 2s. 9d. per cent. for the previous year. The Government again contributed £800,000 towards losses on working country developmental lines, although the actual losses incurred on non-paying lines (after providing for working expenses, interest and exchange) exceeded this sum by £1,127,660. Heavy statutory charges of £6,603,773 had, however, to be met, of which interest took £5,700,000, and exchange on interest remitted overseas £806,000, and the final result of the year's operations was a deficit of £698,262, which was, however, £585,249 less than that for the previous year. No new lines were opened to traffic, and the Broken Hill—Tarrawingee section of 39½ miles, which had been closed to traffic for a number of years, was dismantled.

Earnings from first and second class travel increased by £44,967 and £175,470 respectively, and from workmen's tickets by £59,543 over the previous year, and the total of passenger journeys exceeded the previous year's record by 10,931,221. Parcels, &c., brought in £38,862 more, and the revenue from goods traffic, including live stock, was £9,154,921, an improvement of £572,309. Of the increase of £282,412 in working expenses, an amount of

£455,254 was due to award provisions. A further contributing factor was the amendment of the Public Service (Salaries Reduction) Act which partly restored the reductions made in the salaries and wages of the railway staff. Expenditure on betterments, renewals and partial renewals of rolling stock, track, and other assets was £1,161,238, and the writings off capital account for condemned rolling stock and other displaced assets amounted to £123,645, a total of £1,284,883 compared with £1,353,773 for the previous year. The operating ratio is the lowest since 1918-19, when the figure was 69·33 per cent. Some comparative figures are given in the accompanying table:—

	1935–36	1934–35
Miles open	6,124¼	6,163¾
Train-miles	27,701,005	26,275,459
Passengers	171,142,729	160,211,508
Goods and coal, tons	13,039,314	12,323,693
Operating ratio, per cent.	69·89	72·27
	£	£
Passenger receipts	5,433,176	5,153,196
Goods and coal receipts	8,099,410	7,541,577
Total earnings	16,953,581	16,002,699
Working expenses	11,848,070	11,565,658
Net earnings	5,105,511	4,437,041

The journey time of the limited express trains between Sydney and Brisbane has been further reduced, resulting in the saving of 1¼ hr. in each direction. Further railcar services are being provided for country people wherever traffic conditions call for them. Four diesel-engined trains are being built. The provision of storage accommodation at St. James for six electric 8-car trains has enabled three additional trains to be run during peak hours. Signalling equipment for this accommodation makes it possible for 36 trains an hour to be despatched on one set of rails. Faster timetables for goods train services have been introduced into many country districts. As a result of the provision of an additional marshalling grid in the up yard at Enfield, the marshalling of trains for Darling Harbour, Rozelle, Alexandria, and suburban stations, is more efficiently and expeditiously performed. The length of line wholly or partially renewed by re-railing was 145 miles 46 chains and by resleepering 431 miles 79 chains. Thermit welding of the track has been continued, and a total equivalent to 81 miles of single line was so treated during the year. At Newcastle three manual signal boxes have been closed in consequence of the introduction of a modern power-signalling installation, which enables the whole of the signalling to be controlled from one box. The existing goods rolling stock is to be augmented by a programme of construction by outside contractors. Eighty engines were rebuilt during the year.

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New Swiss Federal Railways Draft Bill

UP to the present, the Swiss Federal Railways have been subject—in addition to the general legislation governing the working of railways—to the provisions of two laws, namely, the Federal Law of February 1, 1923, relating to the organisation and administration of the Federal Railways, and the Railway Nationalisation Law, of October 15, 1897, concerning the acquisition and working of railways on behalf of the State, in so far as the provisions of this law have not been abrogated by those of the 1923 legislation. It is now proposed to replace these various legislative measures by a single law, namely, the new Federal Railway Law, the draft Bill of which has recently been submitted for the approval of Parliament. The message, which accompanies this Bill, is extremely diffuse and recapitulates at length the history and development of the railways since 1898, when they were transferred from private to State ownership. Before touching on the important question of the reorganisation of the railways, the message devotes several chapters to questions pertaining to railway traffic in general and that of the Federal Railways in particular, and explains in detail the interdependence between the proposed reorganisation and the vexed question of the co-ordination of road and rail traffic. Measures are suggested for the solution of the problem of the present failure to make allowance for proper amortisation of the railways and for the prevention of subsequent recurrence of such failure. Attention is also drawn to the fact that railway property has depreciated considerably of late, and that its present value is no longer proportionate to its book value.

In order to reduce its capital, the administration of the railways had previously proposed that the Confederation should take over, as from the coming into force of the new legislation, the interest service and the repayment of the whole of the consolidated and floating debt contracted in favour of the railways, or by the railways themselves, in return for which they would undertake to become debtors of the Confederation at the rate of 3½ per cent. payable on 2 milliards of Swiss francs, or in other words they would pay the fixed sum of 70 million francs per annum. This suggestion was, however, not accepted by the Federal authorities, who have decided to restrict their financial assistance to the taking over of fictitious assets, or difference between the book capital and estimated replacement value, amounting to fr. 510·2 million, plus the deficits arising before the new law becomes operative, and to the sanctioning of an endowment capital of fr. 700 million. With this help it is hoped that the railways will be able to free themselves of a debt of some fr. 650 million before the new law comes into force (presumably, not before January 1, 1938).

The most important points of the draft Bill in question are embodied in articles 19 and 21. In the former it is stated that the Confederation shall authorise the Federal Railways to write off: (1) the difference between the book value of the railway system and its actual replacement value, (2) the expenditure shown in the balance sheet as awaiting amortisation, and (3) the deficit in the profit and loss account, at the time when the new law becomes operative. In addition, the Confederation will sanction an endowment capital of fr. 700 million, and take upon itself to amortise within a period of 60 years, the charges relating to the sums to be written off by the railways under this arrangement. Article 21 contains stipulations intended to restrain the Federal Railways from investing capital in superfluous constructional work, and provides that henceforth only such work as can be met out of ordinary revenue may be undertaken without special permission. By virtue of the new law, the Federal Council will, in future, take upon itself the task of the direct supervision of the management of the Federal Railways, delegating its powers to the directorate-general. As a result of this innovation, the status of railway officials will be affected inasmuch as they will come under the jurisdiction of the Federal Council and not of Parliament, as has been the case up to the present with all categories of State personnel. Those railway employees who were in Government service before the existing law came into force, will retain their status as civil servants. On the other hand, those who were engaged after January 1, 1935, will be dependent on the regulations introduced subsequently by the board of administration, on whom will rest the decision as to whether or not the status of Government employee shall be conferred on the person in question.

XUM

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Railway Geography

158, Bedford Street,
Crewe. January 18

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—Your reference to Sir Josiah Stamp's Presidential Address, and the lecture of Mr. Beaver, Honorary Secretary of the Stephenson Locomotive Society, to the Geographical Association, prompts me to suggest that practical railway geography should be taught in all schools, but more particularly in the commercial centres. If this were done entrants to the railway service would be better equipped for their work, no matter what department, and the public would, in the course of time, be less dependent on knowledge sought at the stations and elsewhere, and be better able to appreciate, and make full use of, the facilities placed at their disposal.

Yours faithfully,
J. BIRCH

Conductor Rails and Coach Vestibules

1584, Avenida Sayago, Peñarol,
Montevideo, Uruguay
January 2

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—Paragraphs and a Letter to the Editor appearing in THE RAILWAY GAZETTE during recent weeks dealing with the fire which occurred in a passenger train on the Southern Railway near Micheldever on August 15 have mentioned incidentally both the above-mentioned parts of railway equipment.

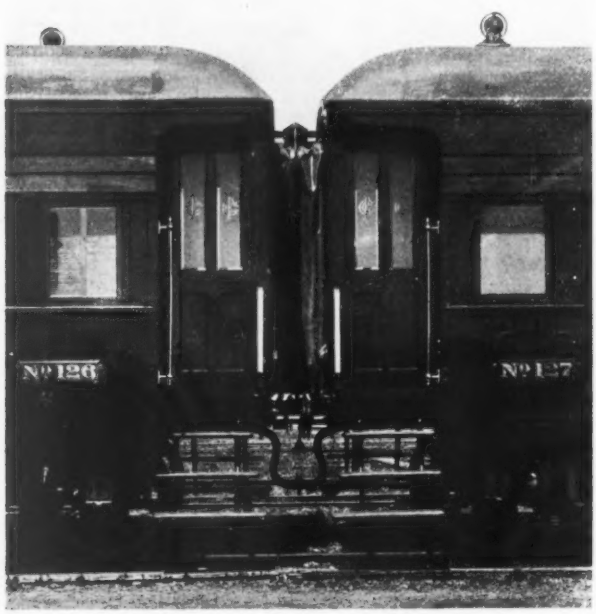
The question of the bare electrical conductor-rail and its possibilites of danger generally appear to be somewhat airily disregarded. Nevertheless fairly frequent notices appear in the press of individuals, most frequently children, being fatally electrocuted by making contact with the live conductor rail. It is remarkable that, as far as would appear from the technical press, no consideration seems to be given to the possibility of avoiding the bare-topped live rail; on certain electrically operated railways abroad, however, the conductor rail is so arranged that the slipper contact is made with the *underneath* face of the rail, which is thus able to be completely boarded in at one side and on the top. This arrangement is obviously almost accident proof, and it also has operating advantages in frosty or snowy weather. Was there any practical reason for not adopting this type of conductor rail upon electrically-operated lines in England?

The recent Ministry of Transport report on the same accident refers to the possibility of the fire having originated from a spark alighting on the gangway bellows (or vestibule) between two coaches. In this connection it has always appeared to the writer remarkable that in England the "long" type of flexible gangway has continued so much in use; there appears no reason why the ends of coaches should not be brought closer together at the gangway plates by which method gangway bellows about half the customary length can be adopted. This has the triple advantage (leaving out the matter of sparks) of cheapening the upkeep of the bellows and gear, enlarging the circulating space at the ends of the coaches, and making it much less troublesome for passengers going from one coach to another when in motion, because there is less distance intervening of oscillating floor and sides of the passage through which they have to pass; further, no connections between the bellows are required to be made when coupling up, as the faces of the adjacent bellows can be arranged to maintain contact by springs in the coach-ends.

A view is enclosed of the ends of a pair of coaches on a Uruguayan railway—where the system has been in use some 25 years—from which a general idea of the short vestibule can be obtained. Is there any reason why this short type vestibule cannot be used on English railways? A somewhat similar one is believed to have been used on the L.N.E.R., from old Great Northern days.

Yours faithfully,
P. C. DEWHURST

[Short Pullman type vestibules, similar to that shown in Mr. Dewhurst's illustration, have been standard on Southern and L.N.E.R. main-line stock for years.—ED. *R.G.*]



Short vestibule connection on Uruguayan coaches

The Summer Timetables of 193?

The Deer Leap, Westcott, Surrey
January 15

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—In your recent article on British express train schedules in 193?, one of the imagined improvements was a smartening up of schedules in general, as distinguished from those of the "crack" expresses. How desirable this is was brought home to me recently on a day journey to and from a place not 100 miles from London. I took the only "fast" morning train, which is allowed some 2 hours 25 minutes for the journey of some 90 miles (average 37 m.p.h.) with five intermediate stops. The engine, of a famous modern express type, lost time steadily, even on this slow schedule; one easy 24-mile stage, for instance, for which the allowance is 29 minutes, actually occupied 36; and the train arrived 15 minutes late.

Returning the same evening, on a slightly faster schedule of two hours, a late start of 7 minutes became a late arrival of half an hour, owing to overtime at stations and signal delays, the engine just keeping time. The weather was fine and clear.

It was a tedious journey both ways, and on working it out afterwards I found that if I had made it by car from my home near London, it would have taken about 40 per cent. less time—an oversight on my part which I intend to rectify on my next trip.

Yours faithfully,
HUMPHREY BAKER

PUBLICATIONS RECEIVED

Deutscher Reichsbahn-Kalender, 1937. Issued by the Press Section of the German State Railway. Leipzig: Konkordia-Verlag Reinhold Rudolph, Goethestrasse 6. 6¼ in. × 10 in., with coloured pictorial cover and 160 tear-off sheets. Price RM. 3·20.—That photography is a national art in Germany is borne out by the continued high standard of the illustrations in the official *Kalender*. The "motto" this year is *Die Reichsbahn im Jahreslauf* (The State Railway through the Year), and the first sheet contains, most appropriately, a beautiful view of a passenger train, still lighted up, setting off through the frosty dawn of New Year's morning. Other sheets belonging to the winter season show impressive snow scenes in the mountains of Upper Bavaria and elsewhere, in some of which full use is made of the "sun, snow, and steam" combination. The coloured cover has a wintry aspect, too, for it shows one of the new glass-roofed observation rail-cars travelling through a frozen Rhenish landscape. Railcars figure prominently among other modern developments portrayed in the succeeding pages. One view is taken inside a glass-roofed car, looking forward along the line over the motorman's head. Another striking picture shows the Fliegende Stuttgarter and the Fliegende Münchener coupled and worked in multiple unit. The interior decorative scheme of these trains includes pictures executed in wood inlay, and lighting tubes along the ceiling give a clerestory effect. Streamlined steam trains are also shown, including that of the Lübeck-Büchen Railway Company, which consists of a high-speed tank locomotive and a double-deck articulated train. Among other modern developments may be mentioned a special permanent way weedkiller train, which consists of eight old locomotive tenders converted into special tank cars, the end one of which comprises the control compartment and a large spray. The opening of the Rügen Dam on October 5, 1936, which has resulted in a material acceleration of the service to Sweden via Sassnitz-Trälleborg, is commemorated by a view of the inaugural train arriving in Rügen from the mainland. The new motor roads (*Reichsautobahnen*) also receive their share of attention. The *Kalender* contains many delightful illustrations of purely scenic interest. Conspicuous are some really good photographs taken from unlikely viewpoints, such as that of an old German country town, seen in passing, from the end platform of a centre-corridor coach. The platform of the next coach, crowded with passengers, none of whom seems at all conscious of the camera, fills up half the picture and makes it convincing. There are two attractive child studies, one of a group of children watching trains at a level crossing and the other of a little girl looking out of a railway carriage window. German orderliness is proverbial; it is characterised by a picture of two turnstiles on each side of a foot crossing. The line is unfenced, but the turnstiles are there because, in Germany, foot crossings must have turnstiles. That, more than anything else, is *echt Deutsch*. By courtesy of Dr. Sommer, head of the Reichsbahn Press Service, we reproduce on pages 148–9 a selection of the photographs used in this *Kalender*. One leaf is allotted to three weekdays, and a separate leaf to Sunday, so that there are upwards of 150 illustrated tear-off sheets.

Great Western Railway 4-6-0 Four-Cylinder Express Locomotive Colour Sectional Plate. London: The Locomotive Publishing Co. Ltd., 3, Amen Corner, E.C.4. 35 in. × 22½ in. Price 1s. 6d., postage extra.—The latest chart published by the Locomotive Publishing Company shows in colour the details of a Great Western Railway 4-6-0 four-cylinder express locomotive, as designed by Mr. C. B. Collett, C.B.E., Chief Mechanical Engineer, Great Western Railway. The sections include elevation, plan and cross sections of the engine only. Various colours are used to distinguish the different materials of which the locomotive is constructed, and these colours considerably assist the student in picking out the components, which, in accordance with the Locomotive Publishing Company's standard practice for these charts, are numbered and accompanied on the plate by a detailed table giving the description of each part. In addition, the plate includes lists of the principal dimensions of both the "King" and "Castle" class locomotives.

Graphical Helical Spring Calculations. ("Mechanical World" Monograph Series.) By W. R. Berry, London: Emmott & Co. Ltd., 28, Bedford Street, Strand, W.C.2. Manchester: 31, King Street West. 5 in. × 7½ in. 22 pp. and folded diagrams. Illustrated. Paper covers. Price 1s. net.—This appears to us to be a most useful publication in its field. It deals with a subject of increasing importance both in railway and other engineering spheres, is practical, and should be of considerable assistance to those who are responsible for designing and fitting springs. The curves and nomograms with which the pamphlet is accompanied, facilitate the determination of the size of wire required for use with a given inside or outside diameter of spring to carry the required load and generate a stress which will be a definitely known proportion of the torsional elastic limit of the particular size and type of wire, allowing for the latest correction for the displacement of the neutral axis of the wire due to the curvature of the spring. Reference to the appropriate nomogram then gives, by the intersection of two straight lines, the complete data of the spring without the need of any calculation whatever. The intelligent use of the charts should reduce the labour of spring designing to a minimum and eliminate many of the failures at present written off as inexplicable, or too readily attributed to faulty wire or manufacture.

L.M.S.R. Tide Tables for 1937.—The L.M.S.R. has issued its tide tables for 1937 in connection with its ports of Garston, Barrow-in-Furness, Heysham, and Fleetwood (Lancs); Goole (Yorks), and Grangemouth, Ayr, and Troon (Scotland). The booklets, which contain detailed information as to tides, depths of water, phases of the moon, etc., together with a plan of each port, and which are bound in handy size for the pocket, can be obtained free of charge on application either to the appropriate local L.M.S.R. officer or to Euston House, London, N.W.1.

Egypt.—An illustrated booklet devoted to a series of inexpensive tours in Egypt reaches us from Thos. Cook & Son Ltd., Berkeley Street, London, W.1. The prices range from 50 guineas for 23 days up to an 80-guinea tour for 30 days, which includes the Nile voyage. In all cases passengers travel overland to Marseilles, proceeding to Alexandria by Misr Line or Khedivial Royal Mail Line steamer. Similar tours can be arranged, however, for passengers wishing to make the whole journey to Egypt by sea. All rates for tours, including those for the Nile voyage, have been specially reduced this year.

Railway Photographs.—Two lists of locomotive and train postcards which we have received from the Real Photographs Company, Cooper's Buildings (4th floor), Church Street, Liverpool, 1, present a varied and conveniently classified assortment of pre- and post-grouping, British and overseas, subjects. Old locomotive types are well represented, and care has been taken in amassing particulars of structural details and similar points of interest to collectors. The same firm supplies storage cabinets and albums for holding the cards. Enlargements of all subjects may be had in three sizes up to 10 in. × 8 in., or larger by quotation. There is also a range of aeroplane and ship postcards.

Wires and Cables.—We have received from the General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2, the 1937 catalogue of Pirelli-General wires and cables. The classification of cables is according to the new standards introduced by the Cable Makers' Association, under which two types replace the previous four. The new types are known as C.M.A. (highest quality) and Nonazo (a cheaper grade). In the new types pure rubber is omitted, the dielectric now consisting solely of vulcanised rubber having outstanding physical and chemical properties. The G.E.C. has also published a convenient card folder for the pocket, giving tables of current ratings for cables and cords.

THE SCRAP HEAP

During the past three months the L.N.E.R. has conveyed by the Harwich-Zeebrugge train ferry no fewer than 117,000,000 English apples to Belgium. This works out at about 17 a head of the Belgian population. There has been an increasing demand on the Continent during recent years for English apples, but shipments have never previously reached this large total.

* * *

GALLANT 319,025

The Argentine "Institute of Economic Studies on Transport" keeps on producing amusing little titbits of information. Just lately it has analysed shareholders' lists and has discovered that 161,641 shareholders and 157,384 Debenture-holders have interests in Argentine rails. The B.A.G.S. has 76,446, the Central Argentine 67,068, the Western only 29,473, the Pacific 36,538, and the Rosario-Puerto Belgrano (surprisingly) as many as 62,800. Compared with the 834,000 holders of British railway stock, these Argentine owners are small in number, and the average holding of Argentine rail stock is smaller than that of Home Rail stock. But the stockholders are not too small in number, nor are their holdings too small, to enable them to be grouped into quite a powerful lobby (or stockholders' union), in order to keep their interests under the eyes of the Powers that Be.—*"Lex," in "The Financial News."*

* * *

THE "TWIN" GUARDS OF THE ROYAL SCOT

Born on the same day 65 years ago the "twin" guards of the L.M.S.R. Royal Scot express went into retirement together last week-end. They retired simultaneously with nearly 100 years of combined service to their credit on the L.M.S.R. and its forerunner, the L.N.W.R. The "twins" are Guards Albert Edward Higgins, of Harlesden, and George Kemp, of Hampstead. Although both were born on the same day—January 18, 1872—Mr. Higgins claims to be the older by a few hours. Between them the two guards have travelled, according to their own estimates, over 8,000,000 miles by train. For the past two years they have been together on the Royal Scot, one in charge of the Glasgow portion of the train, and the other of the Edinburgh portion.

Great changes in railway travel have been witnessed by the "twins" during their long service. "We remember trains lit by oil-lamps, non-corridor coaches on the main-line expresses, and the great excitement caused by the introduction of dining cars," said Mr. Higgins, in an interview. "Until steam heating was perfected, the foot-warmers were a familiar feature at every large station. When an express came in, porters were ready with barrow-loads of them, and they were changed while the train stood at the platform. It is curious that when corridor coaches first came into use, many passengers objected to them because they thought they would do away with privacy."

"You'd be surprised, too, how far we walk just along the corridors looking after the passengers," Mr. Higgins continued. "One day I started a pedometer as soon as the Royal Scot left Euston, and stopped it when we got to Glasgow. It registered over eight miles. Thus the train was averaging about 55 m.p.h., and I was averaging just over 1 m.p.h."

"Both Higgins and I are proud to think that we are able to retire with the knowledge that we have never been late for duty in the whole of our service, and—unlike some passengers I know—have never missed a train," added Mr. Kemp.

During his 36½ years as a main line guard at Euston Mr. Higgins worked every important express in the time-table. A native of Old Bradwell, Bucks, he claims a remarkable family record of railway service, the years of employment of his father, his father's two brothers, and himself totalling 192 years. He entered the service as a boy messenger at Bletchley in 1886. Mr. Kemp, who is a native of Felstead (Essex), started with the London & North Western Railway in 1890.

* * *

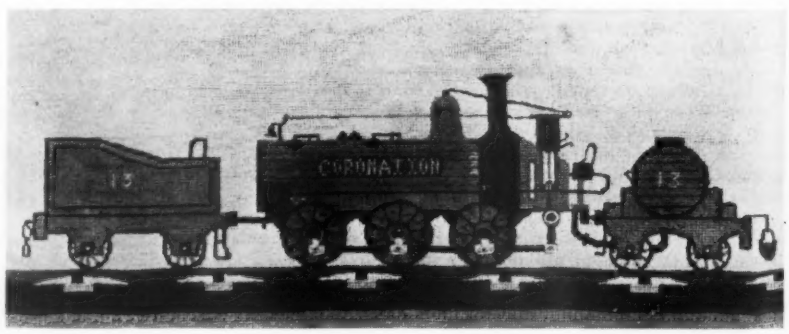
KING'S CROSS CLOCK

The big clock at the top of the tower at King's Cross station is clearly a more sensitive piece of machinery than most examples of its kind. According to *The Manchester Guardian*, it has lately exhibited quite an astonishing show of feeling. The clock was made in 1851 to decorate the Great Exhibition in Hyde Park, and when the Crystal Palace moved to the suburbs the clock was bought by the Great Northern Railway for its London terminus, then being built. The company made a bargain, for it was not only a giant timepiece but a steady worker. All these years it has never gone on strike until now. That is the odd thing. Since the Crystal Palace was destroyed the clock has stopped several times. High up in the tower, there is no doubt that the clock could see the fire raging on Sydenham Hill. Is it coincidence, or has the clock been moping? With the clock is a set of chimes, and inscribed on the bells are the names of Queen Victoria and Prince Albert. The chimes have not been heard for many years, as visitors to the station hotel used to object. As a Coronation gesture it has been suggested to an L.N.E.R. official that the chimes should be got to play again.

* * *

A "CORONATION" ENGINE OF 1831

We are indebted to Mr. Norman Kerr, the railway bookseller of Cartmel, Grange-over-Sands, Lancashire, for the photograph we reproduce below of a needlework picture of Timothy Hackworth's Stockton & Darlington locomotive *Coronation*. The original, which measures 2 ft. in length by 10½ in. in depth, is finely worked in colours. It belongs to the Brigham collection, and, according to Mr. Brigham, was worked by the wife of the driver of this locomotive. *Coronation*, built in 1831, and named in honour of the crowning of King William IV, was one of six engines of the "Majestic" class. The needlework picture is very like a drawing of the engine made by Theodore West, which he claimed to have copied from an outline sketched by the son of William Craggs, *Coronation's* driver. Possibly the same outline inspired Mrs. Craggs to do her needlework, assuming Craggs to have been the driver here in question. Francis Wishaw, in his "Railways of Great Britain and Ireland" gives R. & W. Hawthorn as builder of *Coronation*, whereas Young, in "Timothy Hackworth and the Locomotive," says "the actual erection . . . was carried out at New Shildon" (headquarters of the Stockton & Darlington Locomotive Department), and gives Hackworth as both designer and builder.



A picture in needlework, supposed to have been worked by the wife of the driver of Hackworth's locomotive "Coronation" of 1831

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

VICTORIA

Road Motorcar Type Railcars

The Government Railways are introducing a striking road motorcar type of railcar for country line mail and passenger services in replacement of mixed trains. There are to be ten of these vehicles, of which six have already been ordered. Each seats ten passengers in addition to the driver, and has provision for 12 cwt. luggage, mails or parcels on the roof and at the back. To make these cars conspicuous at level crossings they are painted in yellow and black stripes. The first two services just being established with this type of car are between Shepparton, Dookie, and Katamatite and between Horsham and Goroke; six cars will be required for these duties.

The former service will consist of a daily car (Sundays included) each way between Shepparton and Dookie, and four trips weekly between Dookie and Katamatite; the old service was three trains a week. Connection is made daily with the morning train from and the afternoon train to Melbourne, and a much faster feeder service is being given.

On the Horsham-Goroke line an extra return service weekly will be provided and an additional return trip on Saturday nights between Horsham and Natimuk. The new cars will also operate the postal motor services previously worked by the Sheffield gang car. The other four cars, when received, will probably serve the Birregurra-Forrest, Ararat-Maryborough, and Murchison East—Girgarre—Colbinabbin lines.

Automatic Rail Welding

The first automatic flash butt rail welding machine has been placed in service at Spotswood permanent way depot, and has quickly proved its worth. Welding is so greatly speeded up by the automatic welder—which according to tests at Melbourne University gives results practically equal to the full strength of the rail—that, in the period October 6 to November 14 (excluding Saturday afternoons and Sundays), two shifts, each of 44 hr. a week, completed 2,538 welds with 90-lb. rails welded into 225-ft. lengths for the Newport-Geelong relaying.

Air-Conditioning

So satisfactory have been the results of air-conditioning fitted experimentally in an all-steel dining car and a country passenger coach, that the Government Railways administration has placed orders for 14 more sets of equipment for fitting in vehicles running on country lines where air-conditioning is justified. The first two sets came from England, but except for a relatively small proportion of the equipment, future requirements are being manufactured in Australia. Some sleeping cars also are likely to be air-conditioned before long.

NEW ZEALAND

Conditions Continue to Improve

Recent interviews with the Minister of Railways and the General Manager of the Government Railways emphasised the present and continuing boom in both rail and road traffic conditions, goods and passenger. With the five best months still to come, it is now certain that the annual financial results will show returns approaching those of the early post-war years. Both Messrs. Sullivan and Mackley referred appreciatively to conditions, improvements, and prospects of a much greater development next year, particularly in the Wellington District, where the introduction of electric traction will follow the opening of the new station, the most modern in Australasia.

As indicating the improved business, it was explained that the estimated gross revenue increase of £691,000 during this financial year was in sight with a good margin to spare, as receipts were already over £400,000 to the good. As an example of the enhanced prosperity of the Dominion and its reflection in rail traffics, it was mentioned that on Labour Day the Trentham race traffic totalled 10,155 passengers, compared with only 5,500 in 1935. Such improvement has been general throughout both Islands, and there are indications of still better returns during the summer holidays.

Profit after Restoring Wages

It is evident from these interviews that the new industrial legislation has not adversely affected the railways. After meeting the cost of restoring salaries and wages to the 1931 level, and making provision also for the employment of over 1,000 additional workers, consequent on the introduction of the 40-hour week, the net revenue shows an increase of £3,000 for the past eight accountancy periods in this financial year. Moreover, the Railway Department has not followed the example of most transport services in increasing fares and freights.

A considerable improvement in rolling stock has been effected, a policy that will be continued, and every effort is being made to increase capacity with quality of design and workmanship. Better types of wagons are being provided and speed is being increased wherever possible, though always well within the limits of safety. It may be noted, however, that the speed of New Zealand trains compares favourably with that of train services in other countries with a similar limitation as to gauge and difficult physical conditions. Moreover, considerable work is being done in the removal of the more awkward curves, to further improve speeds, and improvement of grades is also in hand and will be extended.

New Electrified Lines

Further points which emerged from these interviews were that increased suburban railway traffic in the Wellington district is anticipated as a result of electric traction. Electric locomotives will be used on the deviation by way of Tawa Flat to Paekakariki, but the Wellington-Johnsonville electrified line will be worked on the multiple-unit system. The introduction of electric trains will speed up the suburban services, enabling residents on Tawa Flat, for example, to reach town in fifteen minutes. It is expected that this improvement in railway transport will promote extensive housing in the outer suburbs. The new services in 1937 are expected to create a demand for the doubling of certain lines and electric traction round other metropolitan centres.

Railway bus services also show a remarkable improvement in business this year. This feature applies to the new services recently taken over by the Government, and in each case there is already a reasonable margin of profit after providing for interest and depreciation charges and other relevant costs.

BRAZIL

Paraná—Santa Catharina Railway Report for 1935

In the 1935 annual report submitted to the Minister of Transport by Snr. Alexandre Gutierrez, Superintendent of the above railway, receipts, which would have been better had the railway been able to cope with all the traffic offered, are shown to have reached the record total of 45,284:107$400 (excluding taxes), and expenditure amounted to 40,021:222$000, leaving a credit balance of 5,262:885$400. Receipts were therefore 22·2 per cent. higher than in 1934, but operating costs were only 10 per cent. higher, notwithstanding a distribution of 2,183 contos of reis in wage increases. A surcharge of 10 per cent., chargeable on all goods freights and passenger fares, and authorised by law for the purpose of forming a fund for improving the railway and also its employees' wages, produced 2,376:775$500, of which 1,250:167$300 were spent on improvements during the year.

The most notable of these improvements was the continuation of the construction of the Paranapanema branch

line, linking up with the Estrada de Ferro São Paulo-Paraná. Also, stone ballast was laid in 103 km. of track during the year, making a ballasted total of 987 km. out of the 2,006 km. of line open for traffic. The report stresses the urgent necessity for relaying 650 km. of line, and states that to cope satisfactorily with all traffic offering, and especially to avoid wagons standing idle for lack of traction, and to meet the development of competitive means of transport, 25 new locomotives must be acquired immediately. Happily, authorisation had been obtained to float a loan of 50,000 contos of reis for this purpose.

Road competition continued to make itself felt, especially in the region served by the Graçiosa road, which, splendidly constructed, offered a good surface for motor lorries. These latter, operating well inside the technical limits of efficiency, at a ton-kilometre cost equal to that of the railway, were able to compete advantageously, obliging the railway to adopt similar means of transport, which so far had given very promising results. Some operating figures are compared as follow :—

	1934	Percentage of whole	1935	Percentage of whole
Passenger receipts ...	3,999:751$	10·79	5,075:874$	11·21
Parcels receipts ...	1,345:528$	3·63	1,593:177$	3·52
Goods receipts ...	26,052:979$	70·30	30,811:467$	68·04
Animals receipts ...	1,141:430$	3·08	1,355:431$	2·99
Total receipts	37,061:305$300		45,284:107$400	
Working expenses ...	36,401:220$800		40,021:222$000	
Net receipts	660:084$500		5,262:885$400	
Operating ratio... ...	98·22 per cent.		88·38 per cent.	
Passengers—No. ...	839,075		1,093,987	
Passenger-kilometres ...	84,122,585		103,920,464	
Average haul per passenger	100·25 km.		95·00 km.	
Parcels traffic	11,887 tons		12,289 tons	
Parcels traffic	2,512,014 t.-km.		2,785,878 t.-km.	
Average haul	211 km.		226 km.	
Goods traffic	904,803 tons		940,173 tons	
Goods traffic	250,307,564 t.-km.		296,480,563 t.-km.	
Average haul	227 km.		315 km.	

	1934	1935
No. of trains run	51,218	53,163
Train-kilometres	5,341,408	5,709,200
Average run per day	14,634 km.	15,641 km.
Average run per train ...	104·28 km.	107·39 km.

It is interesting to note the development of this railway since 1883 when there were 41 km. of track open to traffic and when receipts were 4 : 400$350, as against 2,006 km. at present open to traffic, and receipts 45,284 : 107$400.

HOLLAND

The Kattenbroek Accident

One of the worst accidents in Holland for many years in respect of material damage, although involving only two deaths and a few injuries, followed the derailment at a set of points near Kattenbroek, on October 7 last, of the 11.16 p.m. Netherlands Railways Utrecht—Gouda train. The carriages were flung across the four lines, and an express goods train collided with the wreckage, destroying a signal gantry, and bringing down telegraph, telephone, and signal wires. All routes westward from Utrecht were blocked. Breakdown trains from Utrecht, Rotterdam, the Hague, and Nijmeegen succeeded in clearing one Woerden—Utrecht line by 6.0 a.m. on October 9, and double line working was resumed by 6.0 p.m. the same day. The goods lines were cleared later. In all, 34 large wagonloads of wrecked rolling stock were removed.

SWITZERLAND

Heavy Winter Sports Traffic

The heavy traffic on the Federal and private railways during Christmas week (reported in THE RAILWAY GAZETTE for January 8) was followed by movements nearly as considerable in the New Year week, when 468 special trains were necessary to carry the additional traffic, and numerous expresses ran in two or more sections. From December 29 to January 4 inclusive, Zurich station despatched 143 specials, Berne 116, Basle 92, Lausanne 90, Geneva 16, and Lucerne 11. The average increase in receipts on the Federal Railways over the corresponding week in 1935-6 amounted to 12·4 per cent.

Appreciable improvements, and in some instances record figures, were reported by most of the private railways serving the principal winter sports centres. The Loetschberg system had to cope with heavy traffic to and from Interlaken, Kandersteg and Gstaad, and Spiez station is stated to have handled the largest number of trains during its existence, specials alone accounting for 465 during the fortnight from December 19 to January 3 inclusive. The Rhaetian, Bernese Oberland, Stansstad-Engelberg, and Rigi Railways were among those which conveyed the greatest numbers of holiday-makers. Cable lines leading to the upper ski-ing slopes of Parsenn, Trübsee, Iltios, &c., ran continuously; the Parsenn railway carried a record number of 3,224 passengers on December 29.

Federal Railways Budget for 1937

The Federal Railways Budget for 1937 as submitted by the Federal Council to the Federal Assembly has now been made public. In submitting it, the Council makes few comments upon its proposals, in view of the fact that the Posts and Railways Department has already submitted a draft Bill and Message reviewing the present situation of the railways and the suggested plans for their thorough reorganisation. The Council, however, expresses the hope that, as the railways administration, in framing its Budget, deemed it inadvisable to take into consideration the possible effects of the devaluation of the Swiss franc upon railway finances, the actual results for 1937 will prove more favourable than is anticipated in the Budget.

Attention is also drawn by the Council to the fact that the estimates have been calculated on the returns for the first three quarters of the current year, when railway receipts were lower than any since the beginning of the economic crisis. In other words the new Budget, while taking into consideration the worst financial conditions to date, allows no credit for possible revival of trade, tourist traffic or economic relations with other countries, resultant from the adjustment of the Swiss franc to the principal international currencies.

As a matter of fact, the accounts for October show that an improvement in railway earnings is already taking place, and, on the other hand, further economies are expected to result from the continued retrenchment policy of the railways administration.

The Budget consists of four parts :—

(1) Construction estimates,
(2) Estimates of working receipts and expenditure,
(3) Statement of profit and loss account, and
(4) Budget of Treasury requirements.

The following are some of the principal comparative figures included in the Budget, in millions of francs :—

Part (1)—

Year	Construction estimates
1930	93·9
1936	29·8
	subsequently reduced to 26·8
1937	24·8

Part (2)—

Year	Gross receipts	Expenditure	Net receipts
1935 ...	314·8	240·4	74·7
1936 ...	312·5	237·6*	74·9
1937 ...	289·9	227·6	62·3

* Reduced by retrenchment from original budget figure of 241·7.

HUNGARY

Transport Minister's Statement

The Hungarian Minister of Commerce and Transport, Mr. Bornemisza, in a recent statement to the press on the transport question, expressed himself as strongly in favour of co-ordination, and said that beneficial results had followed that policy in connection with motor lorry and railway competition. Water and air transport required handling similarly. A new free port at Budapest was to be begun early this year; it would bring much needed facilities to transit traffic. Work was also well in hand on a modern airport at Budaörs, to be opened early this year, which would improve Hungary's position in the international air services.

Railway Facilities in Budapest

The reorganisation of the railway stations in Budapest had, he said, been considered as urgent for some years,

but lack of money had prevented anything being done. The Cegled line approached the West station over a great number of level crossings, but to substitute bridges would be exceedingly difficult, and on the other hand the station could not be closed, as that would be found very inconvenient by numerous business interests. The South station was completely out of date, but a new station, above street level, on the line running to the Kelenföld station, would be able to take its place and enable it to be closed; the trans-Danubian traffic could then be transferred to the East station. No complete solution of the question was possible yet, as the cost would be prohibitive, but plans for certain extensive alterations were now ready. These were estimated to cost 20 million pengös, to be provided principally from State railway, the rest from municipal funds.

Other Improvements

The Minister also pointed out that the financial position of the railways had improved, with trade recovery, but owing to the bad conditions in recent years much track and rolling stock was in need of renewal. In particular, many new refrigerator vans were urgently needed. Further electrification was at present unlikely, as it probably would not pay, but an extension of railcar services was advisable, but would require the raising of more money. An effort was being made to find another way of assisting the towns and rural districts to finance road maintenance and abolish the direct State Railway contributions to such funds, a feature peculiar to Hungarian taxation. The Minister also discussed the reorganisation of the Hungarian Steam Navigation Company and the new plans for highway improvements, especially in the eastern districts, as well as postal and telephone improvements, on all of which large sums were to be spent shortly. A reduction in telephone charges was in contemplation.

UNITED STATES

New Southern Pacific Locomotives

Late in December the Lima Locomotive Works delivered to the Southern Pacific the first six of an order for twenty heavy streamlined 4-8-4 type locomotives. These engines will be used to work the famous Daylight Special services between San Francisco and Los Angeles. The engines have 6 ft. 8 in. coupled wheels, weigh 445,000 lb. (all but 200 tons) and have a tractive force of 74,710 lb. In a handsome livery of orange and scarlet to match the cars of the trains they work, these locomotives will lend much colour to railway operations along the Pacific Coast.

Incidentally, in view of the tendency toward lighter weights in American rolling stock, it is noteworthy that locomotives ordered during the past year tended to be larger than ever. In all, 533 locomotives were ordered during 1936 (the largest total since 1929), and of that number, no fewer than 96 were articulated engines of huge proportions, some of them for fast passenger service in mountain regions. Despite the remarkably successful performance of the light "Hiawatha" class of steam locomotives (4-4-2 wheel arrangement, and tractive force 30,700 lb.), only 18 of the steam passenger locomotives ordered during the year had a tractive force of 50,000 lb. or less. Orders for passenger cars during the year totalled 307 (of which 102 were parts of articulated or semi-articulated trains). Freight car orders totalled 67,544, a larger volume than for any year since 1929.

Another Luxury Low Fare Train to Coast

Led on by the success of the Union Pacific Railroad, fast, air-conditioned train, Challenger, exclusively for coach and tourist (*i.e.*, half-rate) sleeping car travel between Chicago and Los Angeles, the Chicago, Rock Island & Pacific, and the Southern Pacific Railways jointly inaugurated a similar daily service on January 3, their train being known as the Californian. Table d'hôte dining car meals are served at a cost of less than 4s. a day, there are cars exclusively for women passengers, and appointments throughout are most modern.

INDIA

A Chapter of Accidents

The close of 1936 witnessed a number of accidents on Indian railways. Towards the end of November, several goods and coaching vehicles attached to a mixed train left the rails while approaching a bridge between Suffry and Lahwah stations on the Assam-Bengal Railway. These vehicles crashed into and smashed the bridge structure and fell over into the pool below. Several passengers were injured, two seriously. Working day and night for about 24 hours, the engineering staff constructed a diversion of the line which enabled the resumption of train services after a comparatively short interruption.

Early in December, the engine and leading coach of a down local train between Dattapooker and Sealdah on the Eastern Bengal Railway were derailed near Dum Dum junction, they ran into a sand dump and plunged down a 15-ft. embankment. One passenger was seriously injured and subsequently died; twelve passengers, the driver and two firemen received slighter injuries, though some involved detention in hospital.

Then, on the night of December 3, No. 79 up passenger train from Delhi to Lahore was admitted at Ghaziabad on a line occupied by a pilot engine, and in the resulting collision, both engines were derailed. The shunter on the pilot engine was thrown out and severely injured, and the remaining enginemen of the two engines and also twelve passengers received minor injuries.

A further accident occurred on December 6, when the Howrah-Delhi parcels express crashed into a stationary mixed train at Barhan station, about 15 miles from Tundla on the East Indian Railway. The collision caused the death of one passenger and injuries to ten others.

ARGENTINA

Institute of Transport (Argentine & River Plate Centre)

The annual meeting of the above centre was held on November 27 at the headquarters in Buenos Aires. In the absence of the Chairman, Mr. J. G. Mayne (Director, Percy Grant & Co.), Mr. C. R. S. Harris, Vice-Chairman (Director-General B.A.G.S. and B.A.W. Railways), presided. The Chairman referred to the loss the centre had sustained by the departure of Mr. Ronald Leslie (late General Manager, Central Argentine Railway, and now Secretary and London Manager of that Company), and the committee unanimously resolved that the thanks of the officers and committee of the centre be conveyed to Mr. Leslie, former member of the Council, a past Chairman, and a founding member. Prizes were presented to Messrs. A. Hull (Student), Chief Accountant's Department, B.A.P.R., and D. E. Morris (Student), Traffic Department, B.A.W.R., for the best papers during the session by non-corporate members.

The following committee was elected for the ensuing year:—

Chairman: Mr. J. G. Mayne; Vice-Chairmen: Messrs. C. R. S. Harris and A. T. L. Pride; members: Messrs. L. W. Makin, F. A. Bottomley, K. Marshall, G. C. Bonner, J. Harding, H. G. Beckwith, A. S. Matthews, J. A. Meelboom (Hon. Treasurer), and F. C. Egerton (Hon. Secretary). Messrs. Deloitte, Plender, Griffiths & Co. were again elected Honorary Auditors. The meeting concluded with a vote of thanks to the Chairman, the Honorary Treasurer, the Honorary Secretary, the Assistant Honorary Secretary (Mr. A. C. Wren), and the Honorary Auditors.

TANGANYIKA

January-September, 1936, Returns

The approximate revenue earnings of the railway and steamer services for the first nine months of 1936 as compared with the similar period in 1935 were as follow:—

	1935 £	1936 £	Increase + or decrease −
Coaching ...	61,341	69,951	+ 8,610
Goods ...	348,455	393,618	+ 45,163
Telegraph, &c.	12,748	11,823	− 925
L. Tanganyika Steamers...	3,559	3,172	− 387
Total ...	426,103	478,564	+ 52,461

As the total revenue estimated in the budget for 1936 was only £425,500, there was an improvement over this figure of £53,064.

PROPOSED PURCHASE OF CORDOBA CENTRAL RAILWAY

The directors of the Cordoba Central Railway Company have provisionally agreed, subject to the sanction of Congress and to the approval of the stockholders, to sell the undertaking to the Argentine Government

AFTER protracted negotiations and many contradictory rumours as to its intentions, the Argentine Government (as reported in *La Nación* of December 29) has sent a Bill to the Chamber of Deputies, providing for the purchase of the Cordoba Central Railway and the Rafaela Steam Tramway Company (a subsidiary concern) for the sum of £9,500,000, of which amount £700,000 is payable in cash, and the remainder in bonds bearing interest at 4 per cent. per annum and 1 per cent. amortisation. The Bill also provides for the purchase of the company's stock of materials, at a valuation not exceeding £500,000 in cash. As an indispensable adjunct to the acquisition of the Cordoba Central Railway, the Government has also solicited authority from Congress to purchase or expropriate the Rafaela—San Cristóbal branch of the Province of Santa Fé (French) Railway, 108 km. long, for the purpose of linking up the State lines from Santa Fé to Cordoba, and Santa Fé to Tucuman. Alternatively, in the event of the price being considered too high, the Government would seek authorisation to construct a branch not exceeding 150 km., to connect the above-mentioned points, at a cost of $5,000,000 paper, payable in Credito Argentino Interno bonds. The total length of the Cordoba Central Railway is 1,218 miles.

The Government's New Railway Policy

The preamble to the Bill states that the principal object of the purchase of the railway is to fulfil a long-standing aspiration by giving the State Railways direct access to the capital; the secondary aim being the initiation of a new railway policy, which contemplates the gradual acquisition by the State, within financial limits, of the private railways of the country, with a view to giving the nation the entire management of its essential public services. Railway transport, the message states, ought not to be subject to tariffs other than those necessary to cover the cost of materials and rolling stock and meet working expenses, without the addition of interest on invested capital or other profits for investors. This, it asserts, is the only condition under which the railways can operate with maximum efficiency and create the volume of wealth they are capable of doing.

The message goes on to say that the growing tendency in most countries to place the transport services and communications under State control has had the effect of putting those countries which have not adopted this policy in a disadvantageous position, and that, in a homogeneous country like Argentina, steps should be taken to avoid, as far as possible, the advantages which one region may possess over others through its geographical position. In a country of the area of Argentina, such factors as distance, means of access to ports, topography, &c., had a decided influence on the national economy, and it was therefore very desirable to neutralise such inequalities as far as possible. This, the message states, is possible only if the communications and transport services are in the hands of the State, which is thus in a position to consult the public interest rather than the interests of private companies.

The message mentions that the negotiations for the purchase of the Cordoba Central Railway date back to 1934, apart from previous negotiations extending back some ten years, the breakdown of which had compelled the Government to seek for another solution to the problem of providing the State Railways with direct access to the capital, as well as eliminating combined traffic with other lines, which was inconvenient both for shippers and for the State Railways. With this end in view, Congress in 1933 authorised the operation of a ferry-boat service between the ports of Santa Fé and Buenos Aires, with a view to cheapening the cost of transport from the north and west of the republic to the capital, and assuring the independence of the State Railways.

Economic Advantages to the State

The Government considers that the purchase of the railway would be beneficial to the national interests, as it would achieve the objects in view without being a charge on the economy of the country or the national finances. The message points out that the transaction involves a cash payment of only $10,500,000 paper, as the balance of the agreed price—£8,800,000 ($132,000,000 paper)—is payable in State Railway bonds, guaranteed by the nation, the interest on which will be met out of the profits of the working of the railway. In this connection, it is pointed out that the present revenue of the Cordoba Central Railway, plus the additional traffic which is expected to accrue by reason of its incorporation in the State Railway system, and which it at present shares with other lines, together with the resulting saving in working expenses, will be ample to pay the interest on the bonds.

In the message to Congress, the Government points out that, although the railway company assesses the value of the line at some £22,399,000, in view of the depreciation in the property generally, the Government is unable to accept this figure, and assesses the actual value of the railway at £18,357,695, including interest charged on the money advanced for the construction of the railway, or £15,983,214, if such interest is not included.

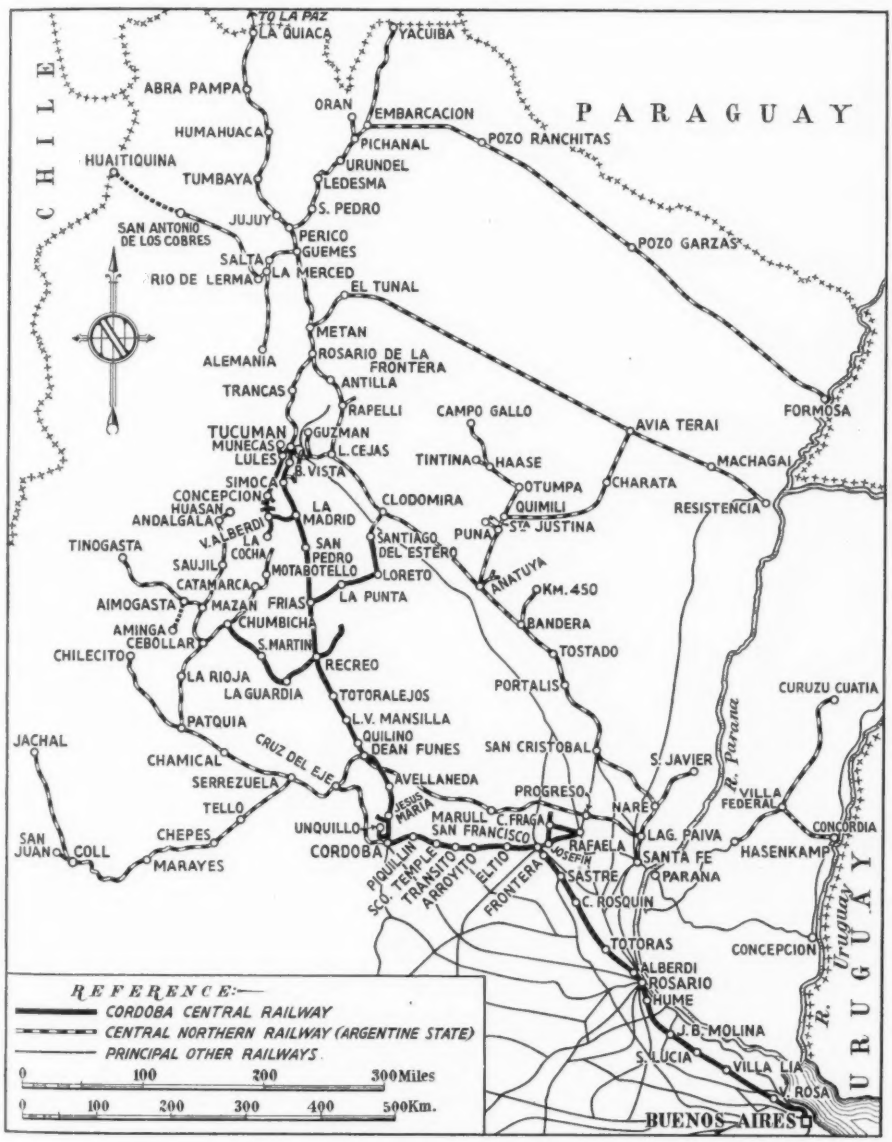
It is pointed out that the purchase price works out at $63,252 paper per km., a very low figure, in view of the fact that the cost of the section between Buenos Aires and Rosario amounted to $125,620 per km., and on the State lines the average cost is over $75,000 per km., for track not so liberally laid down and equipped as that of the Cordoba Central Railway. In this connection, the message states that the terminal stations, workshops, and port installations of the Cordoba Central Railway represent per kilometre of line a much higher sum than the corresponding figure for the Central North (State) Railway; that over 57 per cent. of the tracks of the Cordoba Central Railway are laid with rails weighing over 30 kg. per linear metre; that the number of intermediate stations is 30 per cent. more per km.; the number of units of rolling stock more than double, and that of passenger coaches treble.

Saving to the National Railways

The message states that the acquisition of the railway will save the State Railways Administration the expense of constructing new workshops, running sheds, stations, &c., estimated to cost between $15,000,000 and $20,000,000 paper, the expenditure on which has been already authorised. The economy thus effected will, it is stated, alone

cover the depreciation on the railway property. The Government requests Congress to give the matter preferential attention, so that the negotiations, which have now reached the final stage, may be concluded as soon as possible.

The Cordoba Central Railway, which the directors have provisionally agreed to sell to the Argentine Government subject to the assent of Congress and of the company's stockholders, is a combination of several undertakings merged into a system of 1,218 route miles on the metre-gauge. Its main line, which is for the most part single track, extends for 788 miles from the city of Buenos Aires to Tucuman, where a junction is made with the metre-gauge States lines running through the Northern Provinces and to Bolivia. Rosario, in the province of Santa Fé, 186 miles from the Federal capital, is the second city in the Argentine Republic and, by means of the River Paraná, is accessible to ocean-going steamers. The line also serves San Francisco (322 miles from Buenos Aires) on the border of the provinces of Santa Fé and Cordoba. From San Francisco a branch of 38 miles runs to Rafaela, and there connects with the Rafaela Tramway, which is managed by the Cordoba Central Railway. Cordoba, the capital city of the province of the same name, and third in importance in the republic, is 450 miles from Buenos Aires and 1,364 ft. above sea level. Leaving Cordoba, the line crosses the northern spur of the Cordoba hills, reaching an elevation of 2,624 ft. above sea level, and then runs down the long northern slopes of the hills to the great central depression which is 574 ft. above sea level. The line crosses this plain for 30 miles. At Recreo (613 miles from Buenos Aires), a branch of 109 miles runs to the west to Chumbicha, connecting with the State Railway line to Catamarca. From Frias (658 miles from Buenos Aires) a branch of 100 miles extends to the east of Santiago del Estero, capital of that province. At La Madrid (728 miles from Buenos Aires), on the southern border of the province of Tucuman, the line divides, the main taking a more or less straight route to Tucuman City, 1,430 ft. above sea level; a branch, formerly the North West Argentine Railway, deviates about 30 miles to the west, rejoining the main line at Tucuman.



Sketch map showing the Cordoba Central Railway system and the Central Northern lines of the Argentine State

For the first 100 miles from Buenos Aires, the land, which is generally flat, is given over principally to stock raising, which produces little traffic for the railway. The next 300 miles traversed pass through a rich agricultural district given over almost exclusively to the cultivation of maize. In the northern part, where the soil is lighter, wheat is grown. Linseed is grown in considerable quantities throughout the district. North of the Cordoba hills to the southern boundary of Tucuman (650 miles from Buenos Aires) the district is semi-arid, produces little traffic, and is costly to work on account of the steep grades and scarcity of good water. On entering the province of Tucuman the country becomes extremely fertile and supports a big sugar industry. An important traffic in early vegetables is also carried by the railway from this province to Buenos Aires.

The offices of the administration are at Retiro station, Buenos Aires, and the stores are at Alberdi, near Rosario. The locomotive workshops, built in 1912, occupy a site to the north-east of Cordoba,

and are one mile distant from the main Alta Cordoba station. The most important goods depot is at the north of the City of Buenos Aires, on low ground reclaimed from the River Plate, and it has a convenient access to the port. In Rosario, an important point for the embarkation of grain, the railway has direct access to the port. There is a large excess of south-bound over north-bound traffic, on account of cereals for export, and of sugar and other produce for the Buenos Aires market.

The constituents of the group are the original Cordoba Central Railway Company, the Cordoba & Rosario Railway Company, and the Cordoba Central Buenos Ayres Extension Railway Company. The Cordoba Central Railway Company in its present form took shape on January 1, 1913, when the management and control of the three undertakings were concentrated under its administration.

The most important line of the group is the original Cordoba Central, which up to the end of the calendar year 1912 was working 809 miles of railway, exclusive of the Buenos Ayres Extension Railway. The concession of the original Central Railway dates back to 1887, and in two years' time the line of 128½ miles, running east from the City of Cordoba to San Francisco, was in efficient working order. Prior to the opening, however, the Argentine Government entered into negotiations, and finally sold to the company its Central Northern Railway, running in a northerly direction from Cordoba to Tucumán. To distinguish it from the original line this piece of railway was known as the Central Northern section, and there was subsequently included in it the North-West Argentine Railway of 94½ miles. While the original railway was finally extended to 137½ miles, the Central Northern section became a system of 671½ miles. A reconstruction of the capital had to be undertaken in 1895 owing to the Government failing in respect of its guarantee obligations, while a further rearrangement was carried through in 1908 in order to consolidate the 4 per cent. debenture stocks of the Central Northern section and the North-West Argentine Extension, and the opportunity was taken to create fresh capital for the provision of rolling stock, extensions, and generally in bringing the line up to meet modern requirements. In 1905 the company had also taken steps, in conjunction with the Cordoba & Rosario Railway, to gain an entrance into Buenos Aires, and for this purpose a new company was called into existence under the name of the Cordoba Central Buenos Ayres Extension Railway. Before the amalgamation dividends had been paid for some time on the ordinary stock of the Central Company.

The Cordoba & Rosario Railway of 174 miles ran from Rosario to Frontera (San Francisco) and thence to Rafaela, connecting at Frontera with the Cordoba Central Railway, and at Rosario with the broad gauge system of the Central Argentine Railway. The concession was obtained in 1885, and, as was the case with the Cordoba Central, its early history was one of financial difficulty. Prior to 1910-11 neither the 4 per cent. 2nd preference stock (£432,000) nor the ordinary stock had received any dividend, but for the financial years 1910-11 and 1911-12 the 2nd preference dividend was paid in full and the ordinary stockholders received 3 per cent. in 1910-11 and 3½ per cent. in 1911-12.

The Buenos Ayres Extension Railway, 187 miles in length, running from Rosario to Buenos Ayres, was provisionally opened for through goods traffic in May, 1909, and for passenger traffic three years later.

The combined system at January 1, 1913, had a total length of 1,176 route miles, and the amalgamation of the three undertakings was approved by a decree of the Argentine Government dated January 23, 1913. At June 30, 1914, the route mileage open was 1,186 miles, at June 30, 1926, it had advanced to 1,202 miles, and at June 30, 1927, to 1,218 miles (its present length) by the opening of 16 miles of new branches. The doubling of the line between Buenos Aires and Boulogne, a distance of 13 miles, was completed in 1924, but was not immediately brought into service.

Since the amalgamation several re-arrangements of the capital structure have taken place. After the moratorium granted by the scheme of arrangement of November, 1919, the financial position of the company greatly improved, the payment of interest on all classes of its income stocks was resumed, and a dividend of 2 per cent. on the ordinary income stock was paid for the four years to 1928-29. The gross receipts for the year 1928-29 were the highest recorded in the history of the company, but its history snice then has been one of serious misfortune, and it has suffered more than any of the Argentine railway systems from the effects of the financial depression. At June 30, 1932, the company's capital consisted of £8,000,000 four per cent. first debenture stock, £6,373,422 five per cent. debenture stock, £1,440,000 seven per cent. first preference income stock, £1,661,895 five per cent. second preference income stock, £3,243,436 ordinary income stock, and 107 shares of £1 each. Under a scheme of arrangement sanctioned on July 25, 1932, the first debenture stock becomes a 4½ per cent. stock, the five per cent. debenture stock remains at its former figure, and the preference and ordinary income stocks have been consolidated into an income stock of £6,178,355. An extraordinary general meeting of the company has been called for January 25 to consider a resolution for the alteration of the memorandum of association of the company in order to authorise a sale of its property for a consideration in Government bonds.

Another Sweeping Elimination of Level Crossings in America

One of the most extensive schemes for the elimination of level crossings in the United States is now in hand on the Staten Island Rapid Transit lines of the Baltimore & Ohio Railroad. These lines parallel two-thirds of the coast line of the island, and traverse a suburban area of greater New York City; they are all double track and carry a heavy traffic. Prior to the initiation of the elimination scheme as a whole in 1913, there were 96 level crossings on the 24 miles of line concerned. In that year three important crossings were replaced by under- or over-bridges, and by 1926 six more had disappeared. The important work of raising comparatively long lengths of line was begun in 1930, mainly by throwing up embankments and building steel girder bridges. A further scheme for replacing 15 more crossings was undertaken in 1933, when reinforced concrete viaducts and retaining walls began to be used. The present or 1934 programme, however, involved no fewer than 34 crossings, and the estimated cost was $6,000,000, a figure equal to that for all the previous work done. It is divided into four parts or lengths, two involving viaducts 3,877 ft. and 1,565 ft. in length with long earth embankment approaches, and the other two necessitate the lowering of the line over distances of 6,800 ft. and 3,300 ft. respectively. In all 5,442 lin. ft. of r.c. viaduct, 14 railway and 6 foot bridges or subways are being built; earthwork totals 500,000 cu. yd. and concreting 54,000 cu. yd. The great problem has been to carry on the work without delaying traffic.

WHITE BEARING METALS FOR HEAVY DUTY—I

Composition, structure, and casting practice

(From a correspondent)

RECENT years have seen the publication of a number of detailed studies of the properties and performance of white-metalled bearings, pursued from the engineering standpoint as distinct from the purely metallurgical. Thus, research now bears not so much upon the properties of the whitemetal itself as upon the thermal and mechanical relationship existing between the metal, the shell into which it is cast, and the type of bearing in which it works.

The chief stimulus has come, so far as locomotive engineers are concerned, from considerations arising from the necessity for keeping production costs down and from the requirements of faster and denser traffic operation. The purpose of this article is to describe very briefly some typical bearing alloys; to outline the chief difficulties of manufacture and maintenance; and to review progress in the methods of surmounting them.

The exacting operation of " crack " main line trains may or may not impose greater axle loads, but it does result in an increased demand upon bearings either by higher working temperatures or by more prolonged exposure to the loads and temperatures previously worked at, in consequnce of longer and faster non-stop journeys. The intensification of suburban traffic means increased inertia loads, due to the more rapid starting and stopping of trains. With increasing severity of duty, technical difficulties appear to multiply in geometrical progression. The first reaction to this is probably a search for a " better " white bearing alloy. Practical considerations usually modify this point of view, and it is realised that considerable improvement can be effected by attention to the finer points of design and by special casting technique. We will consider two representative alloys.

Babbitt's original formula for a tin-base alloy has been modified in varying degrees to meet diverse conditions of service. Today a typical Babbitt contains about 83 per cent. of tin, 10 to 11 per cent. of antimony, 3 to 4 per cent. of copper, 1 or 2 per cent. of lead and, in the latest version, 1 per cent. of cadmium. Under the microscope its structure is discerned as a tin matrix (containing some antimony in " solid solution ") principally in the form of minute plates interleaved with lead as a binary (two-fold) eutectic* (Fig. 1.). In this tin-plus-eutectic matrix are embedded cuboid crystals of a hard compound of antimony and tin. Around and between these cubes is a crude mesh formed by a needle-like constituent compounded of copper and tin (Fig. 1). The copper addition is best kept below, say, 5 per cent.,† as it tends to reduce the resistance of the alloy to shock at elevated temperatures. Antimony is advisably kept below 11 per cent. for a similar reason. The presence of copper causes increased precipitation of the antimony-tin cubes, which resist wear and lower the co-efficient of friction. Copper has another function, not perhaps so well known, but quite important. It provides a limiting network or mesh of copper-tin " needles." These freeze out at 250° C., and so largely determine the distribution of the antimony-tin cubes, which freeze when the temperature of the molten lining has fallen to 238° C., and which would tend to segregate into an irregular formation if not thus held. The value of the inclusion of lead in Babbitt metal is much debated. It is intended to increase resistance to crushing at elevated temperatures without affecting the freedom from " wiping " or scoring. The fundamental virtues of a non-homogeneous* bearing alloy as here described are generally acknowledged. They will be referred to again in Part II.

In sharp contrast to Babbitt is Magnolia metal. Alloys

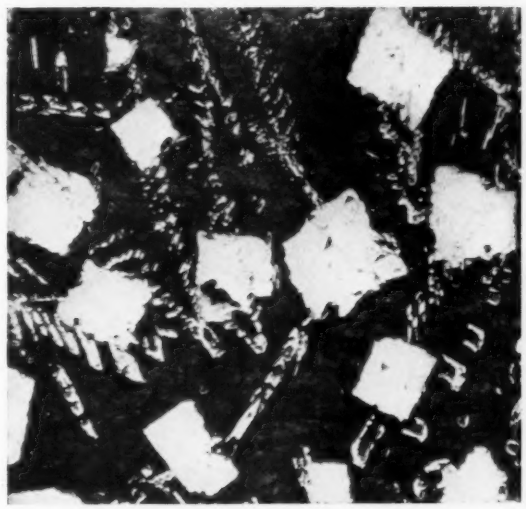


Fig. 1—Babbitt metal (× 75) showing cuboid antimony-tin compound and copper-tin needles

of this type have a lead base and contain approximately 80 per cent. lead, 5 per cent. tin, 14 per cent. antimony and 1 per cent. copper. Bismuth is sometimes included. The microstructure now consists of antimony-tin cubes as before, in a matrix of ternary (threefold) eutectic of lead, tin, and antimony. This matrix is softer than that of a copper-toughened tin-base alloy. It is not adapted to the heaviest duty, but when properly cast will withstand somewhat higher temperatures than a tin-rich alloy under conditions where the capacity for accommodation to bad alignment or flexure of the journals is the chief requirement.

The principles which underlie the successful casting of alloys of such contrasting types as the two here chosen for discussion, have been described by Reichsbahnrat Müller.† It was desired to design chills which would enable a given type of bearing to be lined with any one of three alloys, and would in each case ensure quick and uniform solidi-

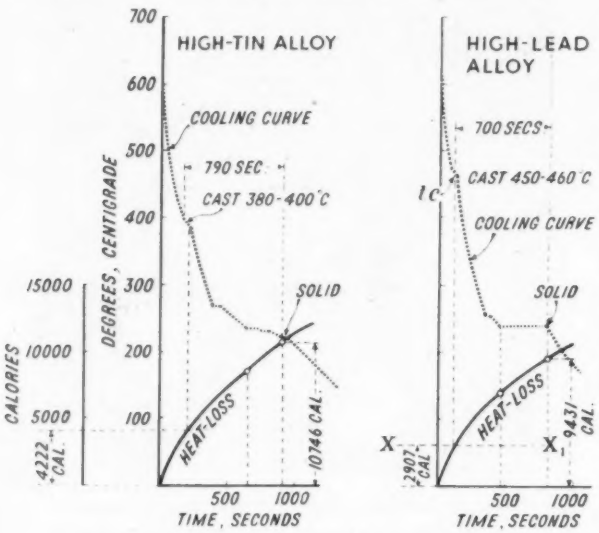
* An eutectic is a structural constituent of constant freezing point, and the last to solidify. It consists of microscopic lamellæ of " excess " constituents which have been thrown out of solution as cooling proceeded. In freezing simultaneously, its components interleave.

† D. J. Macnaughtan " Improvement of White Bearing Metals for Severe Service." Journal. Inst. Metals. Vol. LV, 1934.

* Homogeneous bearing alloys which exhibit only one structural constituent (solid-solution type) have been developed and have given surprising results, but only with ideal lubricating systems.

† Director, Bearing Experiment Station, Gottingen. See *Glasers Annalen*, Sonderheft, July, 1927, and *Zeitschrift des Vereins Deutscher Ingenieure*, 1928, Vol. 72.

fication of all parts of the lining. This means that the melting rate, the mass melted, the casting temperature and the rates of cooling and solidification had to be so balanced as to produce a lining free from cavities or segregation, yet with the least possible residual (shrinkage) stress. The metal was to be precision-cast, and had also to embody the optimum combination of physical properties consistent with mechanical reliability. Experimental melts were prepared, in which a suitable volume of each alloy was allowed to cool under constant external (laboratory) conditions. The speeds of crystallisation, nuclear growth, and solidification peculiar to each alloy were recorded by plotting cooling- and heat-loss curves. These were used to determine the trend of exploratory work, which was now carried out in an experimental chill of simple (ring) form. The manipulation of this chill was planned on a basis of constant heat exchange throughout the series of alloys tried. When this quantity (which turned, of course, upon the volume of the melt) had been fixed, the rate at which the exchange should occur was



Figs. 2 and 3—Cooling and heat-loss curves

estimated for each alloy from the form of the cooling- and heat-loss curves above mentioned, and was then obtained by careful adjustment of the preheat temperatures of the components of the chill, viz., the baseplate, the bearing brass, and the core.

The chill was filled from the bottom upwards. Scum traps were provided in the runners. The baseplate was preheated to approximately the freezing temperature of the alloys (230-240° C.). This was done in order to avoid trouble with the bottom gates, as a higher or lower preheat caused the feed metal either to break through, or to freeze too soon. The core of the chill was heated to 80-90° C. No advantage was gained by varying this temperature. The critical factors were the casting temperature and the temperature of the brass. The coefficient of linear expansion of this latter is only three-fourths of that of the whitemetal lining and in high lead mixtures particularly, tensile stresses of a dangerous order are set up within the lining unless shrinkage differences are minimised by judicious preheating of the brass, which must be as hot as possible. It is also a matter of some importance whether the temperature of the brass continues to rise after the whitemetal lining has started to freeze, and what final equilibrium is established between the two.

Figs. 2 and 3 show two cooling curves obtained by Müller. In these the falling temperature is plotted against time. On them are superimposed two other curves which show the total heat (in calories) lost from the melt at any stage of the experiment (the time of cooling shown refers to a crucible, not to the experimental chill). The arrests in the downward trend of the cooling curves denote changes of structural equilibrium which are accompanied by an evolution of heat. Fig. 2 represents a high-tin alloy as previously described. In the case of the high-lead alloy, Fig. 3, the last and most prolonged arrest marks the solidification of the eutectic matrix.

The casting temperature of the high-tin alloy was put at 380-400° C., which is generally regarded as the most suitable from the standpoint of the physical properties of the lining.* † The time lapse from pouring to complete solidification was 790 sec. From this and other considerations the preheat of the brass was put at 110-115° C., which was found to be correct. This alloy freezes at 236° C., and so the temperature drop (D_1) between lining and brass, at the commencement of solidification, was $236° - 110° = 126$ degrees. The total heat loss from pouring to complete freezing was 10,746 – 4,222 = 6,524 calories (Fig. 2). From these established data the pouring temperature and brass preheat may be calculated for any other alloy used in the same mould. Thus, for a high lead mixture (80 per cent. lead) the line X_1X (Fig. 3) must clearly be drawn to cut the heat-loss curve at an ordinate equal to 9,431 – 6,524 = 2,907 calories. Projecting from X vertically to cut the cooling curve at *tc* we obtain the requisite casting temperature, viz.: 450° C. In the Gottingen experiments the range 450-460° C. was worked to. This does not agree with the temperature recommended by other observers,† particularly for resistance to pounding, but this alone is not necessarily of first importance. The cooling time is seen to be 700 seconds. In order to realise this in the experimental mould it was necessary to adjust the temperature drop (D_2) for the brass in accordance with the desired relative cooling effect, thus:—

$$D_2 = D^1 \frac{700}{790} = 111.7, \text{ say } 112 \text{ degrees.}$$

The freezing temperature for the high lead alloy is 240° C. The brass preheat temperature thus becomes 240° – 112° = 128° C. Actually the range worked in was 125°-135° C. If this was overshot, shrinkage cavities occurred between the lining and the brass.

When these fundamentals had been worked out, they were applied to fast chills specially designed for precision casting. The details took several years to work out. The result was a first-class job. Little or no machining was required. Metal losses were reduced from a mean of 22 per cent. to one of 6 per cent.

THE PETROPOLIS INCLINE.—In the illustrated article on the Petropolis incline, Leopoldina Railway, published in our January 8 issue, the name of one of the firms supplying rack locomotives was inadvertently misquoted as the Kessler Maschinenfabrik Gesellschaft, Esslingen. The correct title of the firm in question is Maschinenfabrik Esslingen, of Esslingen a/Neckar. It is interesting to note that of the 18 rack locomotives of European origin, 14 were built at the Esslingen works, which also supplied all Riggenbach-Esslingen rack-bars in use on the Petropolis incline.

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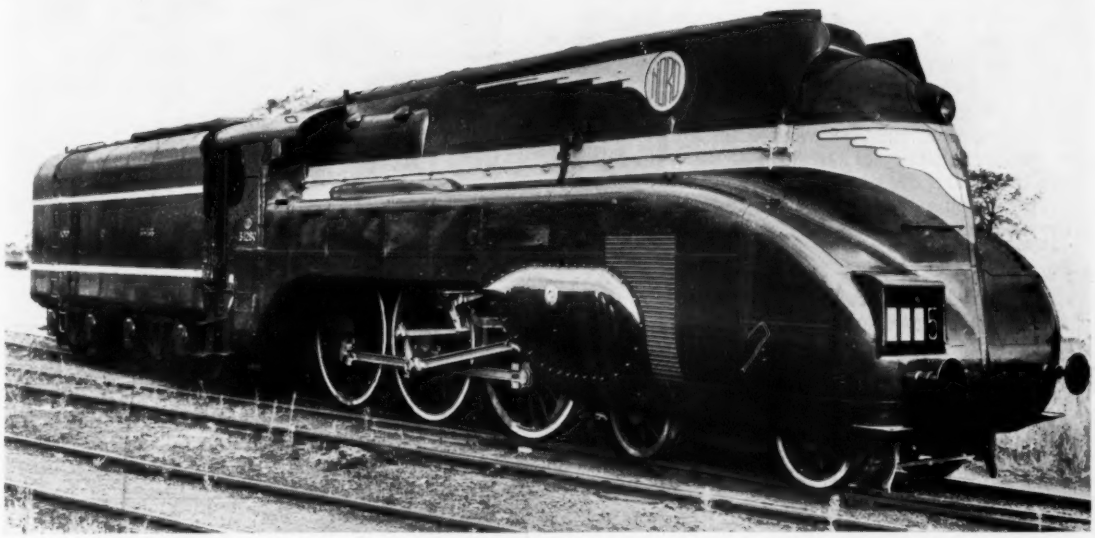
* J. N. Kenyon, "Effect of Addition of Lead to Certain Tin-base Bearing Alloys at Elevated Temperatures." Trans. Amer. Soc. Test Nat. No. 33, 1933.

† H. Greenwood, "Behaviour of White Bearing Metals When Subjected to Various Deformation Tests" (Part III). J. Inst. Metals, Vol. LV, 1934.

STREAMLINING A NORD EXPRESS LOCOMOTIVE

One of the Super-Pacific locomotives (Series 3.1251-3.1290) of the C. de f. du Nord has been experimentally streamlined



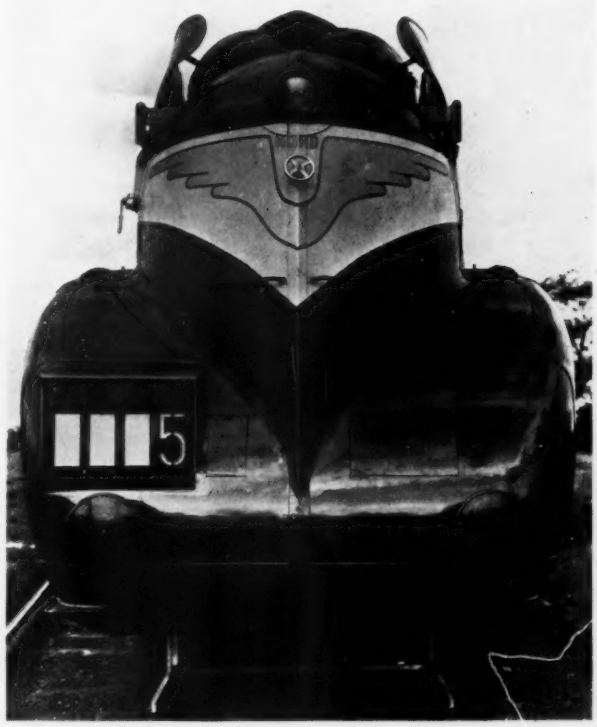
Streamlined super-Pacific locomotive No. 3.1280 of the Northern Railway of France

AFTER conducting tests in the Lelarge wind tunnel of the Institut Aérotechnique, Saint-Cyr, on a 1/10 scale model of a Super-Pacific locomotive of the series 3.1251-3.1290, the Northern Railway of France decided to streamline one of the locomotives of this series, No. 3.1280, in collaboration with the Aérodynamique Industrielle.

The leading dimensions of this four-cylinder compound locomotive are as follow:—

Cylinders, diam., H.P.	440 mm. (17 5/16 in.)
,, ,, L.P.	620 mm. (24 7/16 in.)
,, stroke, H.P.	660 mm. (26 in.)
,, ,, L.P.	690 mm. (27 3/16 in.)
Coupled wheels, diam.	1,900 mm. (6 ft. 2 3/4 in.)
Bogie wheels, diam.	950 mm. (3 ft. 1 1/2 in.)
Bissel ,, ,, ...	1,040 mm. (3 ft. 5 in.)
Boiler working pressure	17 hpz. (246 lb. per sq. in.)
Boiler heating surface	196 sq. m. (2,109 sq. ft.)
Superheater surface	61 sq. m. (656 sq. ft.)
Total	257 sq. m. (2,765 sq. ft.)
Grate area	3·5 sq. m. (37·4 sq. ft.)
Wheelbase, rigid	4,020 mm. (13 ft. 2 1/4 in.)
,, total engine	10,420 mm. (34 ft. 2 3/16 in.)
Weight of engine in working order	104·5 metric tons (103 tons)
Maximum theoretical tractive effort :	
Compound	17,160 kg. (37,840 lb.)
Simple	23,030 kg. (50,780 lb.)

The main parts of the casing were made in the company's La Chapelle (Paris) shops. The front formation is on a plywood framework. In order to give easy access to the motion-work, numerous inspection doors are provided, some being fitted with roller shutters, as



Head-on view of the locomotive

for example in front of the high-pressure (outside) cylinders.

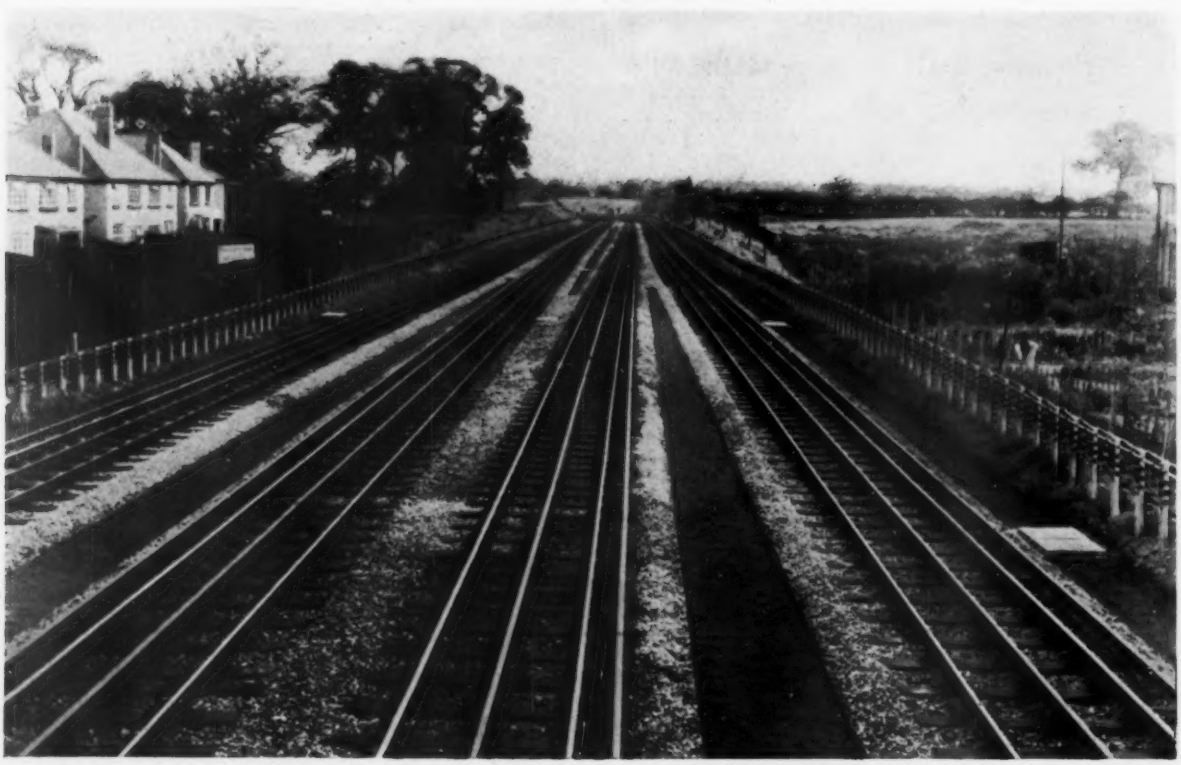
The smoke-lifting arrangement consists of plates substantially parallel to the longitudinal axis of the locomotive, the upper edges of these plates converging as shown opposite and extending to the back of the cab-roof. These plates are one on each side of the polyhedral enclosure of the chimney, steam dome, sand dome and other fittings, the object of the combination being to create a zone of high-pressure beneath the smoke blanket, and at the same time to reduce to a minimum the aerodynamic resistance of the inevitable protuberances on the boiler. The glass cab windows have been replaced by direct-vision look-outs, and the streamlining of the tender is an extension of that of the locomotive.

The locomotive thus equipped was officially placed in service on Sunday, October 11, 1936, at the Gare du Nord, hauling the train carrying representatives of the Southern Railway, the Sleeping Car Company, and the Nord to inspect the equipment of the Dunkirk-Dover train-ferry boat.

Before entering the shops for streamlining, the locomotive was subjected to very careful road tests in a series of ten trials with brake locomotives and a dynamometer car. These trials have since been repeated with the streamlined locomotive, and showed, for the engine and tender alone, an increase in power of 120 h.p. at 120 km.p.h. (74½ m.p.h.) and 200 h.p. at 150 km.p.h. (93 m.p.h.). The saving in fuel consumption was 1 kg. and 1.34 kg. per km. respectively at these speeds.

Smoke-lifting arrangement, super-streamlined locomotive, Northern Railway of France

London Transport Permanent Way

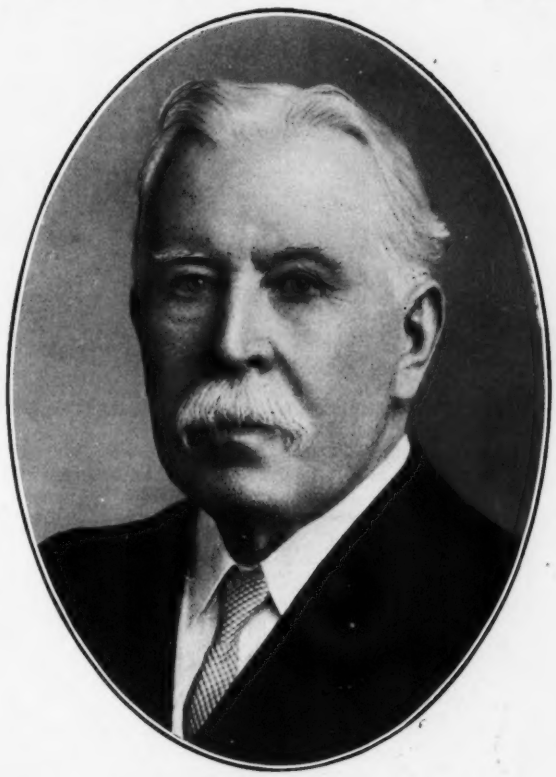


View looking west between Acton Town and South Ealing, showing the well-ballasted and tidy permanent way typical of the surface railways of the London Passenger Transport Board. From left to right the tracks are: District westbound line, Piccadilly westbound and eastbound lines, and District eastbound line

John Audley Frederick Aspinall

WE regret to record the death, on January 19, at the age of 85, of Sir John Audley Frederick Aspinall, M.Inst.C.E., M.I.Mech.E., formerly Chief Mechanical Engineer, then General Manager, and finally a Director of the former Lancashire & Yorkshire Railway. Born in Liverpool in 1851, he was educated at Beaumont College and was articled as a pupil successively to Mr. Ramsbottom and Mr. Webb at Crewe works, L.N.W.R. He was afterwards appointed Assistant Manager of the steelmaking plant at those works, having also control of the erection of all new buildings connected with the Locomotive Department. In 1875 Mr. Aspinall was appointed Works Manager of the locomotive, carriage and wagon works at Inchicore (Dublin), Great Southern & Western Railway, which post he held until promoted to be Locomotive, Carriage & Wagon Superintendent of that railway in 1883. Three years later, at the instance of Mr. Ramsbottom, then a Director of the L. & Y.R., Mr. Aspinall was offered and accepted the post of Chief Mechanical Engineer of that system and proceeded to reorganise the department and lay out and equip the new locomotive workshops at Horwich. In 1899 he was appointed General Manager, the position he held until his resignation at the beginning of 1919, when he was elected to the board of the company as a Director. In October of that year, however, he resigned his seat on the board consequent upon his appointment as Consulting Mechanical Engineer in the Ministry of Transport. In 1925 Sir John, who had received his knighthood in 1917, was appointed Consultant to the General Manager and the board of the London Midland & Scottish Railway. Among other supplementary appointments he had held were: Chairman of the General Managers' Conference (Railway Clearing House); President of the Institution of Mechanical Engineers (1909 and 10); Member of the Railway Executive Committee during the war; President of the Institution of Civil Engineers (1919), and of other engineering institutions and societies. He held a Telford Premium and a Watt Gold Medal for papers on locomotive subjects, and he was also Lt.-Col. in the Engineer and Railway Staff Corps, a Knight of Grace of the Order of St. John of Jerusalem, a Knight of the Order of Leopold, and an Honorary Doctor of Engineering of Liverpool University.

In addition, he became President of the Institution of Civil Engineers in Ireland (1884-6). He was a Vice-President of the Exhibition of Inventions in London in 1885, and was elected a member of the Iron and Steel Institute two years later. In 1888 he was awarded the Telford Premium for his paper "Friction of Locomotive Slide Valves," and in 1892 was elected a Member of Council of the Institution of Mechanical Engineers. Mr. Aspinall, as he still was then, was President of the Liverpool Engineering Society in 1898; he was also Associate Professor of Railway Engineering at Liverpool University. One of his greatest technical papers was "Train Resistance," presented to the Institution of Civil Engineers, for which he was honoured with the Watt Gold Medal (1901-2). This paper, now considered a classic, was based on dynamometer car research and established the relatively great importance of wind pressure, as affecting trains.



The late Sir John A. F. Aspinall,

Formerly Chief Mechanical Engineer and General Manager of the Lancashire and Yorkshire Railway

Mr. Aspinall's selection as General Manager of the L. & Y.R. in 1899 was an honour extremely rare for a mechanical engineer, but it was based on his proved ability and broadness of outlook. As General Manager his principal achievements were a far-reaching reorganisation of operating methods, the securing for this company in the face of fierce opposition from other railways, access to the South Yorkshire coalfield, and, by negotiating running powers, the securing of through running for L. & Y.R. trains from Liverpool, in the west, to Goole and Hull, on the East Coast. Mr. Aspinall was in this connection General Manager and then Managing Director of the Dearne Valley Railway. He greatly enlarged the scope of L. & Y.R. shipping, and also the port facilities at Goole, until before the war that company, with 28 steamers, was the largest steamship owning railway. He was, however, perhaps best known as a leading pioneer in railway electric traction and was responsible for electrifying the network of lines between Liverpool, Southport, and Ormskirk, and between Manchester and Bury. Begun in 1903, the Southport line was in full electric working in October, 1904. The whole of the preliminary research work and the determination of principles involved in the conversion from steam to electricity were decided upon by Mr. Aspinall and his assistants without outside expert advice. About this time he was a member of the Viceregal Commission on Irish Railways.

And now this most remarkable career has closed, though appropriately it was crowned at the last moment by the award, last December, to Sir John of one of his most prized honours, the James Watt International Medal for outstanding achievements in mechanical engineering.

(*Reference to the funeral arrangements is made on p.* 160.)

XUM

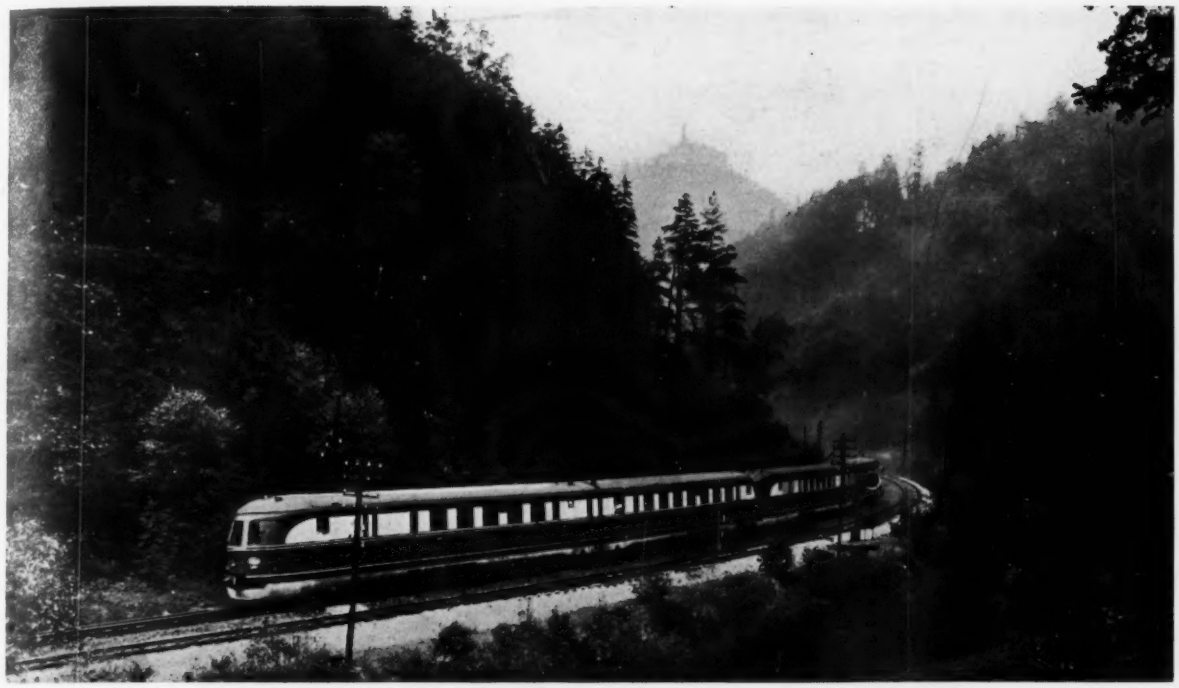
SOME VIEWS FROM THE REICHSBAHN KALENDER

(*See review on page* 135)

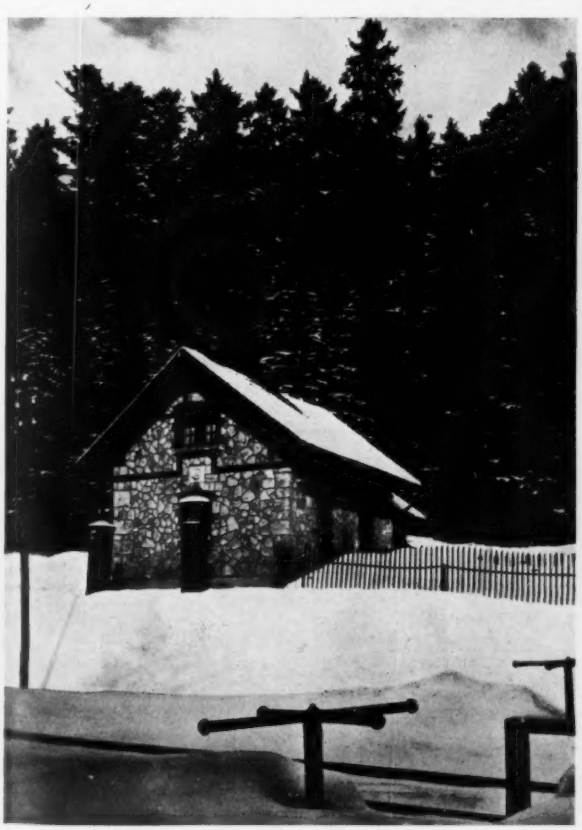
A weed-killing train functioning. These trains consist of old locomotive tenders used as tanks containing chemical weed killer, the last of which has a control cab and sprinkler

Enginemen of a main-line locomotive. As for practically all the outdoor staff, uniforms are provided by the Reichsbahn

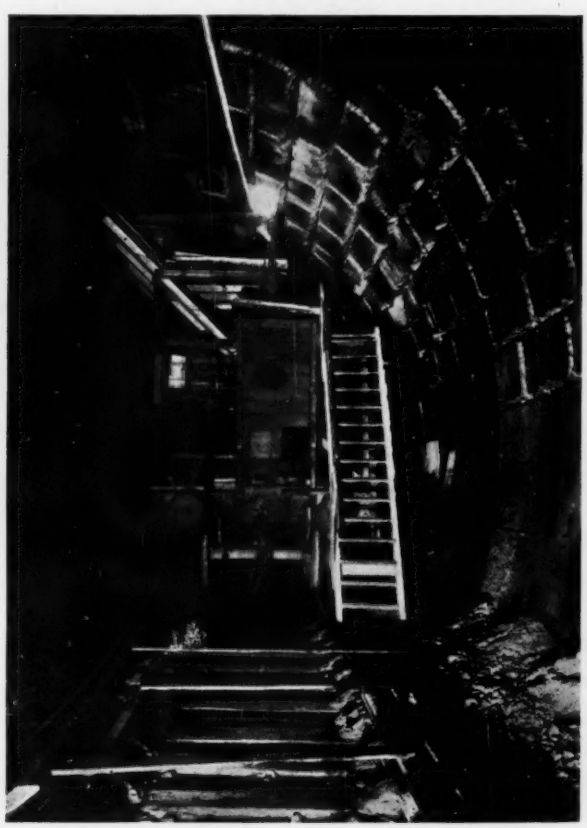
Cleaning and polishing main-line rolling stock on the German State Railway. The familiar "smoking" and seat number plates will be noticed



The "Fliegende Münchener" and the "Fliegende Stuttgarter" near Burg Lauerstein. These two diesel-electric units run coupled together between Berlin and Nuremberg, whence one proceeds to Munich and the other to Stuttgart



A country station waiting room. Note the turnstile indicating the crossing place for passengers, despite the absence of a level crossing barrier



Tunnel repairs in progress. Note the cast-iron chairs normally used in German State Railway tunnels to secure the flat-footed rails

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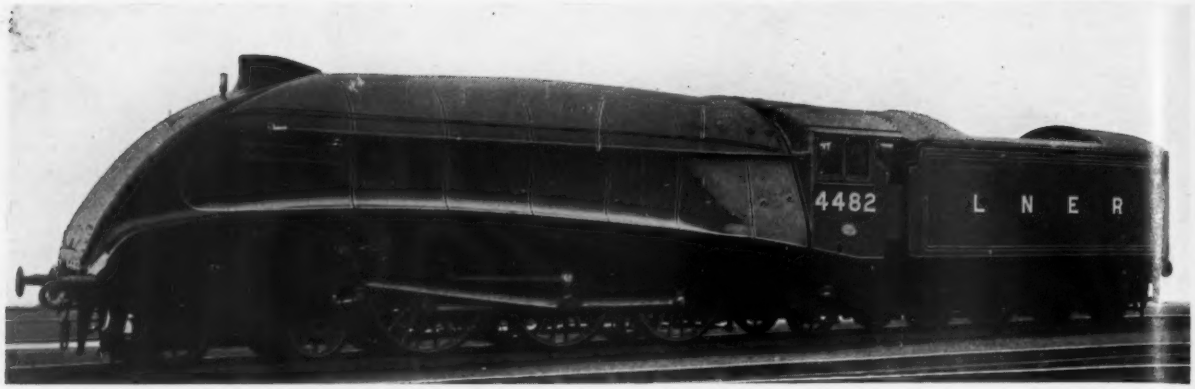


L.N.E.R. locomotive No. 4482 "Golden Eagle," the first of the new series of streamlined express passenger engines. These have similar dimensions to those of the "Silver Link" type, but are finished in L.N.E.R. standard green

Ascending car on the funicular railway to the heights of Corviglia, carrying skiers who will make the descent to St. Moritz 2,000 ft. below, which is seen spread out amid the pine trees

Photo.] [Swaine

The ninth annual dinner and smoking concert of the Great Western Railway units, Royal Engineers (Transportation Units, Supplementary Reserve), held at Porchester Hall, Paddington, on Saturday last. (*See report on page* 155)

RAILWAY NEWS SECTION

PERSONAL

L.N.E.R. Appointments

The London & North Eastern Railway announces that the following appointments have been made:—

Mr. J. C. L. Train, Assistant Engineer (Maintenance), Southern Area, to be Assistant Engineer, Southern Area.

Mr. W. Y. Sandeman, District Engineer, Glasgow, to be Assistant to Engineer (General), Southern Area.

Mr. T. H. Seaton, District Engineer, Stratford, to be Assistant to Engineer (New Works), Southern Area.

Mr. G. B. Barton, District Engineer, Boston, to be Assistant to Engineer (Maintenance), Southern Area.

Mr. H. E. Stratton, Bridge Assistant (Steelwork), Engineer's office, Liverpool Street, to be Assistant to Engineer (Bridges), Southern Area.

Mr. B. P. Fletcher, District Engineer, Cambridge, to be District Engineer, Stratford, in succession to Mr. T. H. Seaton.

Mr. J. P. Allix, District Passenger Manager, Leeds, to be District Goods and Passenger Manager, Cambridge, in succession to Mr. A. B. Coulter, who retired from the service on December 31 last.

Mr. E. J. Stephens, Assistant District Superintendent, Doncaster, to be District Superintendent, Lincoln, in succession to Mr. G. Sutcliffe, who has recently been appointed District Superintendent, Cambridge.

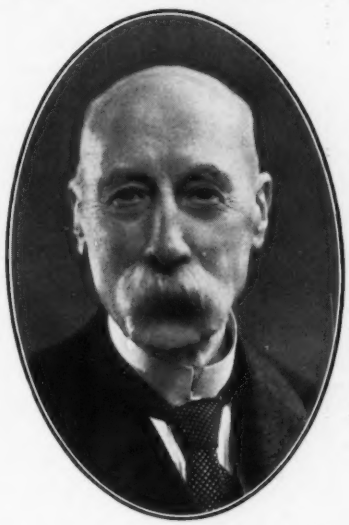
Mr. A. M. Creasey, Chief Signalling Inspector, Superintendent's office (Western Section, Southern Area), to be Assistant District Superintendent, Doncaster, in succession to Mr. Stephens.

Mr. H. G. Sayers, Dock Superintendent, Eastern Docks, Hull, to be Assistant Superintendent, Southern Scottish Area, in succession to Mr. H. Arnott, who has recently been appointed Assistant Superintendent, North Eastern Area.

Mr. C. Corps, Goods Agent, Newcastle Forth, to be Dock Superintendent, Eastern Docks, Hull, in succession to Mr. H. G. Sayers.

Mr. C. J. Brown, who, as announced in The Railway Gazette of December 11 last, is retiring under the age limit next Wednesday, from the position of Engineer, Southern Area, London & North Eastern Railway, entered the Engineer's Department of the former North British Railway as a pupil in 1889. After varied experience and rapid promotion he became Chief Engineer of that system in 1909. Two years later he left the N.B.R. to take up the position of Chief Engineer of the former Great Northern Railway. After the amalgamation in 1923, Mr. Brown took over charge of the Engineer's Departments of the old Great Central Railway in that year, and of the Great Eastern Railway in 1925, thus becoming responsible for the whole of the Southern Area of the L.N.E.R. in the latter year.

Mr. William Frederick Burleigh retired from the service of the Westinghouse Brake and Signal Co. Ltd.



Mr. W. F. Burleigh,

who has retired after a signalling and interlocking career extending over a period of 66 years

on December 31, 1936, after the remarkably long career of 66 years in mechanical signalling work. Son of the late Mr. Benjamin Burleigh, a civil engineer, he was born in 1851 and from 1868 to 1870 was employed in the drawing office of Matthew T. Shaw, Head & Co., constructional engineers, Cannon Street, London; this was before the days of blue prints, when all drawings had to be copied by hand. From 1870 until 1910 Mr. Burleigh served with Stevens & Sons, signal engineers, who then had works in Southwark and Glasgow but are no longer in business. This firm was closely associated with the early days of signalling development, and one of its staff, the late James Deakin, originated the now widely-used tappet system of interlocking, patent No. 746 of 1870. The firm supplied apparatus to many railways, especially those in Scotland and to the London & South Western Railway. Mr. Burleigh began setting out interlocking mechanism for Stevens & Sons in 1871, and has been concerned with many important installations, including the modifications to the Waterloo "A" box in 1878 and 1885, the construction of the remarkable 236-lever locking frame made by Stevens & Sons in 1892 for the last "A" box and illustrated on page 800 of our issue of November 13 last, for which Mr. Burleigh designed much special locking. He was also associated with subsequent modifications to this frame. In 1910 Mr. Burleigh joined McKenzie & Holland Limited, another long-established signalling firm, and has been from 1920 until his retirement with the Westinghouse Brake & Signal Co. Ltd. at its York Road offices, where he has designed the interlocking for a very large number of locking frames.

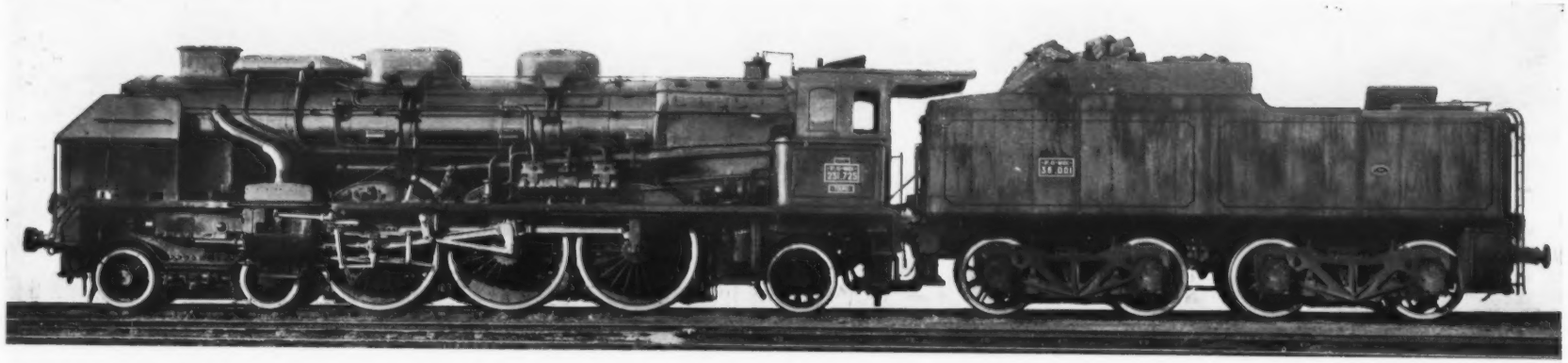
Major M. P. Sells has been appointed to act as General Manager, Nigerian Government Railway and Colliery, during the absence on leave of Mr. J. H. McEwen, as from January 2. Mr. McEwen has already arrived in England.

Lt.-Col. W. R. Izat (R.E. ret.) has been elected a Director of the Bengal Dooars Railway Company, to fill the vacancy on the board caused by the death of Sir Henry Burt.

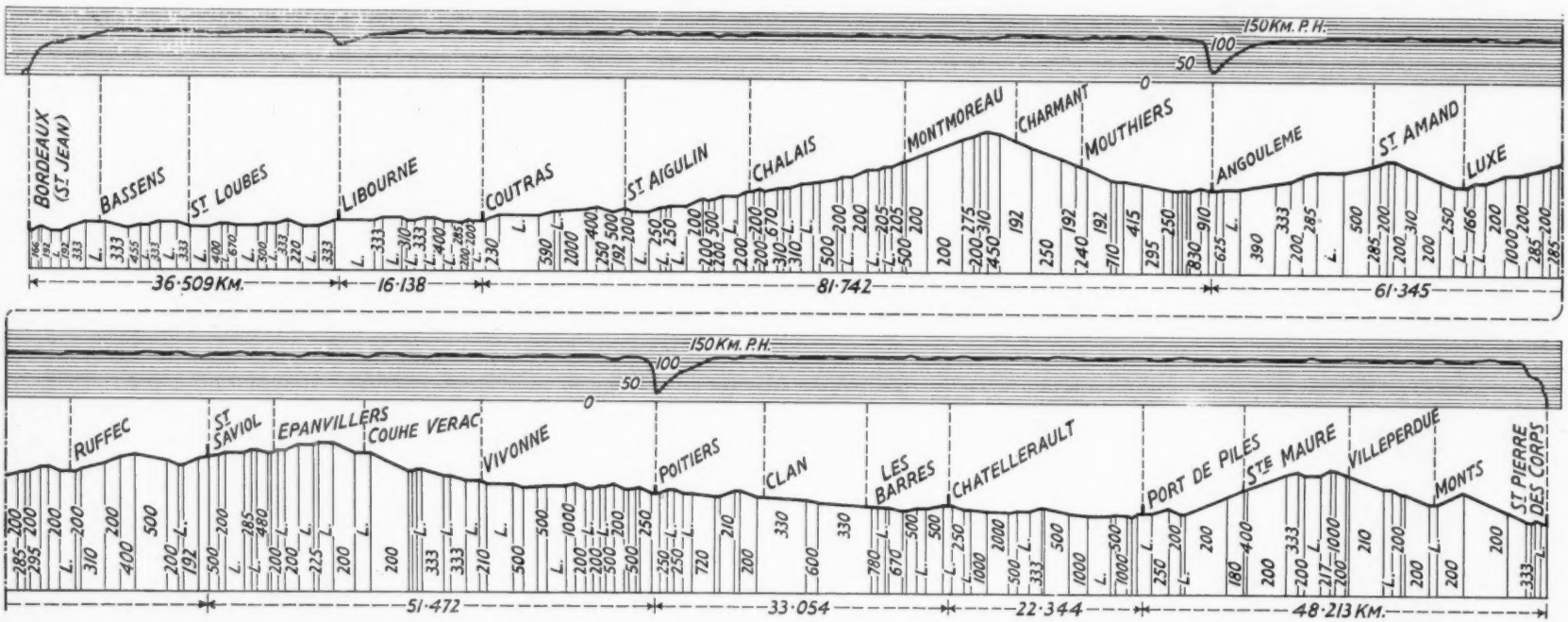
Mr. R. C. Rogers, who for some time has acted as Assistant to the late Managing Director of Vickers Train Lighting Co. Ltd., Mr. Percy Grant, has been appointed General Manager of that company.

The Grand Council of the Federation of British Industries has unanimously approved of the nomination of Lord Hirst for the office of President of the Federation for the year beginning in April next.

We regret to record the death, on December 30, of Col. T. A. Hiam, formerly Assistant in British Columbia to the late Sir Henry Thornton, President of the Canadian National Railways. Born in 1886, Col. Hiam joined the Grand Trunk Railway in 1901, and was appointed Chief Clerk to the General Manager, Canadian Northern Railway, in Eastern Canada, in 1905, being transferred to the office of the Vice-President at Toronto two years later. During the war he served in various infantry and Royal Engineer units in France and Macedonia, and was a member of the Inter-Allied Commission after the war. Later Col. Hiam was appointed a Director of the Anatolian section of the Baghdad Railway, but returned to railway work in Canada in 1919. In the following year he became Technical Adviser for Railways to the League of Nations and subsequently visited all European countries in connection with railway matters. It was in 1920 that he relinquished that post to become Assis-



Chapelon rebuilt Pacific locomotive No. 231.725 P.O.-Midi Railway, which ran from Bordeaux to St. Pierre des Corps, 216·7 miles, at an average start to stop speed of 72·2 m.p.h., with a 400-ton load, without exceeding 75 m.p.h anywhere and with no lower speed than 68½ m.p.h. on 5 miles of 1 in 200 up grade



Flaman record of the run of No. 231,725 in November last, showing the extraordinary uniformity of speed throughout the whole run uphill and down

tant to the President at Vancouver, the position from which he retired in 1932.

We regret to note the death, on January 18, of Mr. T. A. Hayward, Managing Director of Hugh Smith & Co. (Possil), Ltd., in his 80th year.

Sir George H. Sutherland, who has been a Director of the Bengal & North Western Railway since 1922, has resigned from the board owing to ill health, and Lt.-Col. A. H. C. Sutherland, O.B.E., M.C., has been elected to fill the vacancy so caused.

Mr. S. J. Page, M.C., has been appointed Assistant Secretary in charge of the Secretarial Department of the Ministry of Transport, to fill the vacancy caused by the death of Mr. E. W. Rowntree, C.B.E. Mr. Page, who is a permanent member of the establishment of the Ministry, has, however, until now been acting as Secretary of the Railway Rates Tribunal.

SOUTH AFRICAN STAFF CHANGES

The following S.A.R. & H. appointments and leave prior to retirement are announced:—

Mr. C. H. Hamilton, O.B.E., Superintendent (Commercial and Operating), Kimberley, to be Superintendent (Staff), Headquarters.

Mr. D. J. J. du Plessis, Assistant Manager, Publicity and Travel Department to be Superintendent (Commercial and Operating), Bloemfontein.

Mr. G. S. Leverton, Commercial Assistant to Airways Manager to be Assistant Manager, Airways.

Mr. G. E. Titren, Chief Superintendent, Motive Power, has proceeded on leave of absence prior to retirement after 43 years' service.

Mr. C. W. King has been appointed Assistant Divisional Engineer, London East Division, Southern Railway. Mr. King was educated at Dover College and then became a pupil of the late Sir P. C. Tempest, General Manager and Chief Engineer of the South Eastern & Chatham Railway. Subsequently he joined the staff of Mr. G. Ellson (then Resident Engineer, S.E. & C.R.) in 1922, and, after the formation of the Southern Railway, was engaged on constructional works for electrification schemes, including the remodelling of Cannon Street station and the conversion of the Brighton line. He was then attached to the London East Division in 1933 and 1934, but in 1935 became Technical Assistant to Mr. C. A. G. Linton, Assistant Engineer (General Maintenance), and assisted with the organisation for the rearrangement of lines from Waterloo to Wimbledon. Mr. King later acted as Assistant to the Chief Engineer, for Electrification Works, until he was appointed to London East Division as Acting Assistant Divisional Engineer in July, 1936, the post in which he has now been confirmed.

Remarkable French Locomotive Performances

Chapelon rebuilt Pacific hauls 400-ton train 217 miles non-stop at an average of 72¼ m.p.h. with a maximum of 74½ m.p.h.

THE remarkable performances in earlier years of the compound Atlantic locomotives introduced on the Northern Railway of France as far back as 1900 are a matter of common knowledge; it was, in fact, the reputation that they had established which caused the Great Western Railway of England to make a trial of three similar locomotives from the same builders (the Société Alsacienne de Constructions Mecaniques, of Belfort, France), imported in 1903 and 1905. These engines were designed by M. du Bousquet, then the Chief Mechanical Engineer of the Nord, in collaboration with M. de Glehn, then Director of the Belfort company. In view of the increasing popularity of *trains rapides légèrs*, or light high speed trains, in France, and also to supplement the high speed motor-train services, the Nord has lately reconditioned engine No. 2659 of this type with most successful results. The actual changes are slight, but chief among them is the provision of the Lemaître variable exhaust arrangement, requiring a new chimney of large diameter which considerably alters the external appearance of the engine. This arrangement was illustrated and described in THE RAILWAY GAZETTE of April 17, 1936. At the same time exhaust deflector plates have been added, this having been found necessary after trial, despite the height of the chimney, owing to the low terminal pressure at which exhaust takes place. The cost of the alterations has been very slight, but the engine is now admirably suited to the haulage of trains up to 300 tons weight at average scheduled speeds in the region of 68 m.p.h.

The dimensions of these four-cylinder compound Atlantics, which remain unchanged, are driving wheels 6 ft. 8½ in. dia.; high pressure cylinders 15⅜ in. diameter and low-pressure cylinders 22 in. diameter, with a common stroke of 25½ in.; 29·7 sq. ft. of grate; 1,505 sq. ft. of heating surface and 431 sq. ft. of superheating surface; a working pressure of 227 lb. per sq. in.; and an adhesion weight of 35½ tons. The last-mentioned figure might be considered a severely limiting factor to the usefulness of these engines, but this does not appear to be the case. On trial, No. 2659, after reconditioning, exerted a drawbar-h.p. of 1,580 at 56 m.p.h., as compared with 1,380 at the same speed with the original exhaust arrangements, and at 75 m.p.h. a d.b.h.p. still as high as 1,420 was being maintained. The power output of the reconditioned Atlantic at speeds in excess of 65 m.p.h. is, indeed, found to be superior to that of the Nord Pacifics of the 3.1151-3.1170 series built in 1912.

As to examples of the performance of No. 2659, on the North Star Pullman express, non-stop from Paris to Brussels, the schedule of 189 min. for the 193·1 miles was easily observed with a load of 341 tons, notwithstanding a p.w. check and adverse signals outside Brussels. Starting 3 min. late from Paris, the engine passed Creil, 31·2 miles, in 28 min. 30 sec., mounting the whole of the 1 in 200 to Survilliers at between 68 and 71½ m.p.h. Cut-off was 58 per cent. in the h.p. and 75 per cent in the l.p. cylinders during the ascent. On the 4.20 p.m. *rapide* from Turcoing to Paris, with 359 tons, No. 2659 ran the 41·0 miles from Arras to Longueau in 38 min. 30 sec., start-to-stop; Creil, 47·0 miles, was passed in 44¾ min. from Longueau, despite ½-min. loss by a permanent way slowing, with a speed varying between 58 and 71½ m.p.h. up the whole of the ascent to Gannes (at its steepest about 1 in 250), and this in very bad weather conditions, with frequent squalls of rain and wind, which at one exposed point brought the speed down by over 10 m.p.h. (a partial outcome, probably, of limited adhesion weight and consequent slipping).

With the 10.15 a.m. from Paris to Lille and Turcoing, and a train of 301 tons, No. 2659 ran the 47·0 miles from passing Creil to Longueau stop in 43½ min. inclusive of a 20 m.p.h. slowing over permanent way works approaching Longueau; cutting off at 55 per cent. in the h.p. and 75 per cent. in the l.p. cylinders the engine mounted the ascent to Gannes at a sustained 68½ m.p.h. up the 1 in 300 grade, covering the 22·1 miles from Creil up to the summit of the incline in 20½ min. With a lighter load of 289 tons, on the southbound Blue Bird Pullman express, which does the 193·1-mile journey from Brussels to Paris in 3 hr., at an average of 64.4 m.p.h., a gain of 5 min. was effected without the speed at any point exceeding 74½ m.p.h. The gradient from Mons up to Quévy, varying from 1 in 77 to 111, was finished at 56 m.p.h., with the cut-off at 55 per cent. in the h.p. cylinders; on the 1 in 77, with the h.p. cut-off at 65 per cent., the lowest speed was 52 m.p.h. The 22·0 miles from Aulnoye to Busigny were run in 17¾ min., and the 28·6 miles from St. Quentin to Noyon in 23 min., pass-to-pass in each case, at an average speed throughout each length right up to the 74½ m.p.h. limit.

We have also received from Baron Vuillet some notes of a journey made by him on the footplate of No. 2659, when this engine was hauling the northbound Blue Bird Pullman express, made up to six cars which weighed 287 tons tare and 295 tons gross. Down the initial fall from Paris

Flaman record of the run of No. 231.725 in November last, showing the extraordinary uniformity of speed throughout the whole run uphill and down

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to St. Denis 65 m.p.h. was attained, this 3·8 miles taking 6 min. 10 sec., but at the foot of the 1 in. 200 ascent to Survilliers the train was checked by signal to 20 m.p.h. Cut-off was then advanced to 55 per cent. in the h.p. and 70 per cent. in the l.p. cylinders, and with 227 lb. per sq. in. pressure in the h.p. steam-chest, and 50 lb. in the l.p. chest, the engine accelerated to 52 m.p.h. by Goussainville, and to a maximum of 58 m.p.h. on the slightly easier length beyond, finally falling back to 56 at the summit of the 1 in 200, with two-thirds of a glass of water still showing in the gauge. Creil, 31·2 miles was passed in 35 min. 55 sec., or 31 min. net. Speed rose to 70 m.p.h. at St. Maximin, and from here to Tergnier was maintained at about 74 m.p.h., Tergnier, 81·5 miles, being passed in 80 min. 10 sec., or 73¼ min. net, after a permanent way slowing costing 2 min. Along this length cut-off was 40 per cent. in the h.p. and 70 per cent. in the l.p. cylinders, steam pressure 228 lb. in the h.p. and 59 lb. —a notable figure—in the l.p. steam chests, and the steam temperature was 680 deg. F. With 50 per cent. cut-off in the h.p. cylinders, 65 m.p.h. was reached up the 1 in 333 to Essigny, St. Quentin, 95·1 miles, being passed in 92 min. 22 sec. (85½ min. net). The 1 in 200 grade to Busigny was surmounted at an average speed of 62 m.p.h. and a minimum of 59 m.p.h., cutting off at 52 per cent. in the h.p. cylinders, and with the water level at two-thirds of the glass; Busigny, 112·1 miles, was passed in 108 min. 15 sec. (101¼ min. net), and Landrecies, 125·1 miles, in 119 min. 30 sec. (112½ min. net). The remainder of the journey was largely spoiled by a dense fog, though conditions as far as Landrecies had been clear; the net time from Paris to Brussels, allowing for the fog delays, is estimated at 176 min. for the 193·1 miles—a remarkable feat for a locomotive of such moderate dimensions, not to mention its by no means inconsiderable age.

The account of these performances, for which, with the exception of the last-mentioned, we are indebted to our Paris contemporary *Transports*, remarks that the value of reconditioned locomotives of this type will be greatly enhanced when the speed limit is raised from the present 120 k.p.h. to 140 k.p.h., or 87 m.p.h., for it is to power output at high speed with moderate loads that the reconditioned design is particularly suited. A beginning in this direction has already been made, however, by the relaxation of the speed limit to 130 km.p.h. (80¾ m.p.h.) in the case of steam-hauled trains of all-steel stock, over sections of line equipped with automatic block signalling; this now applies to the Nord main lines between Creil, Longueau, and Arras, and northwards from Paris between Creil and Tergnier. In all, from September 10 to October 24, No. 2659 made nineteen return journeys between Paris and Brussels on the four non-stop Pullman expresses, with successful results. A similar reconditioning has taken place of Nord 4-6-0 No. 3.999, which has shown itself capable of handling 490-ton trains on the normal express train schedules of this company, or within 100-150 tons of the capacity of the much larger super-Pacifics. This was originally an experimental 4-4-2 locomotive, later converted to 4-4-4 bearing No. 2.741.

The value of the higher permissible maximum speed is well illustrated in a recent run with a heavy load, for details of which we are also indebted to Baron Vuillet. The engine was one of Chapelon Paris-Orleans Pacifics, No. 3.1172, now at work on Nord metals, and the train of eleven all-steel cars, on the 8.15 a.m. service from Paris, weighed 476 tons tare and 505 tons gross. On passing St. Denis (3·8 miles in 5 min. 49 sec.) the engine had attained 66 m.p.h., but then was brought to a dead stand by adverse signals, losing 6 min. There was an acceleration to 51 m.p.h. before and 57 m.p.h. after Goussainville (where the gradient eases slightly), and the summit of the 1 in 200 was breasted at 55 m.p.h.; with the usual 74 m.p.h. descent past Chantilly, Creil, 31·3 miles, was passed in 37 min. 50 sec., or 31¾ min. net. Speed then rose to 70 m.p.h. at Clermont, and averaged 64·4 m.p.h. between km. posts 66 and 86, up the continuous ascent mostly at 1 in 250-330. Gannes, 54·3 miles, the summit, was passed in 59 min. 34 sec., the lowest speed having been 63 m.p.h. Downhill, 30 km. continuously were covered at an average of 78 m.p.h., and the 13 km. between posts 108 and 121 at an average of precisely 80 m.p.h., with a momentary maximum of 82 m.p.h. Longueau, 78·3 miles, was therefore passed in 78 min. 29 sec., or 72½ min. net. After this a speed of 72 m.p.h. was maintained on the level, and after a minimum of 57 m.p.h. up the 1 in 200 to Achiet, and a maximum of 78 on the succeeding descent (the 130 km. limit extends also from Longueau to Arras), the stop at Arras, 119·4 miles from Paris, was effected in 115 min. 49 sec., or 109¾ min. net. The schedule allows 116 min. From Survilliers to km. 189, 99·1 miles were covered with this 505-ton train at an average of 69·2 m.p.h.

Uniform Speed Runs by Chapelon Locomotives

An exceptional test run was made recently over the same route by No. 3.1194, another Pacific of the same type. With a light load of 236 tons, the engine ran from Paris to Longueau, 78·3 miles, in 63½ min., at an average start-to-stop speed of 74·2 m.p.h. A feature of the run was the very rapid acceleration from the start; St. Denis, 3·8 miles, was passed in 4 min. 58 sec., the train having already, on the sharp decline out of the terminus, attained a speed of 73 m.p.h. From there onwards, including the 1 in 200 ascent to Survilliers, and the long 1 in 300 climb to Gannes, speed was continuously at the 120 km.p.h. (74½ m.) limit, except for the slack over Creil curve to 57 m.p.h. Allowing for the stops at Longueau, Arras, and Douai, the net time over the 155¾ miles from Paris to Lille was 2 hr. 25 min.

Yet another striking example of the capacity of the Chapelon rebuilt Paris-Orleans Pacifics for sustained high speed was given over the main line of that company during the month of November last, on the occasion of a journey by members of the International Railway Union from Bordeaux to Paris. The train, consisting of eight coaches with a total weight of 397 tons, was drawn by engine No. 231,725, in charge of Driver Loury, of Tours engine depot. By special arrangement it left Bordeaux 25 min. late, according to the schedule which had been laid down, and 3 min. further was lost by a permanent way slowing to 6 m.p.h. immediately after the start. Other speed reductions were to 50 m.p.h. through Libourne, 15 m.p.h. through Angoulême, and 15 m.p.h. through Poitiers; both these invariable stops by the long-distance expresses were omitted, and the 216·7 miles from Bordeaux to St. Pierre-des-Corps were covered without any intermediate stop. The remarkable feature of the running, as revealed by the Flaman records, is that the speed of the train, apart from the start and the recovery from the three slacks, remained absolutely without variation at between 110 and 120 km.p.h., that is to say, at from 68½ to 74½ m.p.h., the latter figure, which is the legal limit, not being exceeded. Up to Charmant summit, to which there are gradually rising grades for 23½ miles, including one 5-mile stretch at 1 in 200 approaching the summit level, the speed was maintained continuously within these limits, and up the 1 in 200 at an average of 71 m.p.h. Up past St. Maure, again, there is a continuous 8-mile ascent at 1 in 200, on which speed fluctuated between 68½ and 71 m.p.h. It is, indeed, doubtful if any such extraordinary uniformity of speed as that revealed by the Flaman record of this run has ever previously been kept up by a steam locomotive, over an undulating road like this, for a distance exceeding 200 miles, and the more so as rain and high wind made the weather conditions particularly unsuitable for speed records. The actual time for the 216·7 miles from Bordeaux to St. Pierre-des-Corps was 3 hr. 3 min., or, allowing for the one out-of-course slowing (the p.w. check leaving Bordeaux), but not for the service slacks at Libourne, Angoulême, and Poitiers, the net time was 180 min., which gives an average start-to-stop speed of 72·2 m.p.h., with a by no means negligible load of round about 400 tons. It may be noted that this run, as well as the fastest of the journeys previously described, was made without any assistance from streamlining of engine or coaches.

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Argentine Co-ordination of Transport Bill

On January 8 (page 73) we published a brief review of the Argentine National Co-ordination of Transport Bill, but since then we have received some further information on the subject from our correspondent in Buenos Aires. This takes the form of the following notes on the passage of this important measure, on the modifications to which the original draft of the Bill has been subjected, and on the composition of the National Committee or Commission for the Co-ordination of Transport.

What was ostensibly the sudden intention of the Senate to deal with the national Transport Co-ordination Bill in its session of January 4, followed next day by a motion to terminate the debate and vote on the measure at 8 p.m., proved that the Senate had for a long time past resolved to pass the Bill in its own good time. As there was all along a majority in favour of the measure—on this occasion 13 to 4—and as the Government supported the measure, obviously there had been nothing to prevent this step being taken months ago, instead of waiting until the end of the extraordinary sessions of Congress. As on previous occasions, there was some opposition from two or three Radical and Socialist senators, but the Government majority had resolved to pass the measure without further delay, and no opposition was brooked.

The Minister of Public Works (Dr. Manuel R. Alvarado) refuted the arguments of the opposition that to pass the Bill was to pander to the wishes of British capitalists—the railways in particular—and stated that the measure would meet an urgent national necessity of a judicial and economic character, and marked a definite step in the direction of progress and law and order. The Government, he said, claimed for itself the honour and responsibility of the initiative, and, while accepting the modifications introduced by the Chamber of Deputies, trusted that the Senate would give the Bill its approval, so as not to delay any further its application. With this strong backing from the Government spokesman, it is not surprising that there was no further opposition, the Bill being passed and being sent forward for promulgation with only four votes against.

Since it was first presented to Congress in August, 1932, the Bill has undergone considerable modifications in the interests of the road motor concerns, some of its provisions having been whittled down to such an extent as to rob them of much of their value. Nevertheless, it is a step in the right direction, and following so closely on the passing of the Urban Transportation Bill, which benefits the Buenos Aires tramways, it shows that the Argentine Government is not unmindful of the valuable services which the foreign-owned railways have rendered to the Republic, and is determined that they shall be accorded the equitable treatment to which they are justly entitled, by abolishing the one-sided advantages which their road competitors have hitherto enjoyed, and putting both forms of transport on an equal footing as regards tariffs and working regulations. It is this claim for equality with their road competitors which the Argentine railways have been urging upon the Government, and which the new law is meant to secure.

Under the original scheme, the regulation of rail and road transport was to be placed under the jurisdiction of the Director-General of Railways, but in 1935, certain important changes were introduced into the scope and provisions of the Bill by the Chamber of Deputies, the responsibility for the working of the scheme being vested in a committee or commission, as recorded in THE RAILWAY GAZETTE of September 6, 1935.

According to Article No. 1 of the law now passed, this committee will be composed of seven members consisting of a President—to be nominated by the Government, with the approval of the Senate—to hold office for four years, be eligible for re-election, and receive a salary of $2,000 paper a month; the President of the National Roads Board, the General Manager of the State Railways, the Director of Navigation and Ports, the Director-General of Railways, one representative of the private railways, and one representative of the road motor companies. The two latter shall hold office for four years, and will be eligible for re-election. They will be nominated by the Government from a list of ten candidates selected by the respective entities. With the exception of the President, all the members of the committee shall discharge their duties without remuneration.

G.W.R. Units, Royal Engineers Supplementary Reserve

(*See illustration on page* 150)

The ninth annual dinner and smoking concert of the Great Western Railway Units of the Royal Engineers, Transportation Units, Supplementary Reserve, was held at the Porchester Hall, Paddington, last Saturday.

Major E. C. Cookson presided, and was supported by Majors K. L. Yorath and R. H. Edwards. About 250 officers, N.C.O's., and men attended, the men coming from all parts of the Great Western system. The visitors included:—

The Rt. Hon. Lord Portal, M.V.O., D.S.O.; Colonel W. G. Tyrrell, D.S.O., Asst. Director of Transportation, the War Office; Colonel R. Carpmael, O.B.E., M.Inst.C.E., M.I.Mech.E., Chief Engineer, G.W.R.; Lt.-Col. D. J. McMullen, D.S.O., Commandant, Railway Training Centre, R.E., Longmoor; Lt.-Col. F. Potter, Superintendent of the Line, G.W.R.; Major A. S. Quartermaine, M.C., Assistant Chief Engineer, G.W.R.; Major C. A. Langley, M.C., R.E.; Major F. J. Biddulph, M.C., R.E.; Major S. E. Tyrwhitt; Major F. Holland; Captain C. E. A. Browning, R.E.; Captain R. E. Bagnall-Wild, R.E.; Captain J. A. B. Grylls, R.E.; Captain P. D. G. Buchanan, R.E.; Messrs. A. C. Cookson, C. T. Cox, H. Adams Clarke, J. A. Kay, J. W. A. Kislingbury, J. F. Lean, R. A. F. Setterfield.

The toast of "The G.W.R." was proposed by Major Cookson, and was responded to by the Rt. Hon. Lord Portal, M.V.O., D.S.O., who, intimating his pleasure at being present, said he was proud that the G.W.R. had raised 3 such units, and that the strength of the companies was being well maintained.

The toast of the "Regular Army" was proposed by Major K. L. Yorath; and Colonel W. G. Tyrrell, D.S.O., Assistant Director of Transportation, War Office, replied. He wished to dispel the idea of a dividing line between the Regular Transportation Units and the Supplementary Reserve Transportation Units; the regular units were dependent on the Supplementary Reserve, evidence of which was the fact that some members of the Supplementary Reserve Operating Companies were called up for service in Palestine during the last few months.

The toast of "The Supplementary Reserve" was proposed by Colonel R. Carpmael, O.B.E., M.Inst.C.E., M.I.Mech.E., Chief Engineer, Great Western Railway. He referred to the good work of the companies and the growth of the Railway Training Centre, Longmoor. He was pleased to say that the directors of the group railways were participating in the provision of memorial windows in the new Garrison Church, Longmoor, in memory of men of the railway troops who gave their lives in the great war. A window was to be provided by each railway group. Major R. H. Edwards replied, and, referring to the strengths of the companies, said that they did not advertise for recruits, but the greatest medium the units had was through the men themselves.

The Sir James Milne cup for General Efficiency among the three companies was presented by Lord Portal to the 154th (G.W.) Railway Operating Company.

The "Lean Bowl" for sports was presented by Mr. J. F. Lean to the 152nd (G.W.) Railway Construction Company.

The "Bowler" cup for shooting was presented by Lt.-Col. D. J. McMullen, D.S.O., R.E., Commandant, Railway Training Centre, Longmoor, to the 154th (G.W.) Railway Operating Company.

The "Browning" cup for the best shot of the whole of the Transportation Units, Supplementary Reserve, was presented by Captain C. E. A. Browning, R.E., to Spr. Allen of the 154th (G.W.) Railway Operating Company, who scored a "possible."

Entertainment was provided by an orchestra and several artistes, and an enjoyable evening was spent by all.

Activities of the Electrical Industry in 1936

During the year 1936 the recovery from slump conditions was maintained, and the improvement in trade, more particularly in home trade, was reflected in the reports received from firms engaged in the manufacture of electrical equipment. Much business was transacted with railways, and several developments opened up fresh possibilities for the use of electricity in railway service. Of particular interest were the activities detailed below.

The General Electric Co. Ltd.

Multi-point control equipments were supplied for new rolling stock built to the order of the London Passenger Transport Board. The new stock, which is to give higher acceleration and higher maximum speed than the earlier equipment, consists of units made up of two motor coaches permanently coupled together and having driving compartments at each end. All the control apparatus is mounted under the cars. Further work in hand for the L.P.T.B. comprises six control equipments and 400 motors for the Hammersmith and City and Metropolitan Lines.

To the existing range of Osira high-pressure mercury lamps there was added a smaller lamp of 150 watts rating. Special measures are being taken to ensure a satisfactory efficiency in small mercury lamps, and the range of Osira lamps will shortly be extended in the downward direction.

The English Electric Co. Ltd.

Contracts were received covering the whole range of the company's manufactures, including electric and diesel traction equipment. An improvement in overseas trade was noted.

The British Thomson-Houston Co. Ltd.

Control equipment was ordered by the L.P.T.B. for three 2-car experimental high-speed tube trains. An order from the Southern Railway for 230 high-speed circuit breakers was completed, and a further order for 292 similar breakers was received. When the latest order is completed the total number of B.T.H. circuit breakers supplied to the S.R. will be nearly 1,000.

Substation equipment ordered for railways comprised many rectifiers and also a repeat order from Wilson & Herd Limited for four transformers to be used in rectifier substations on the Germiston-Pretoria section of the South African Railways. These will be similar to eleven already supplied for the Randfontein-Springs section. The rectifiers for use with all these transformers have been or are being made by the B.T.H. Company, and others have been and are being completed for the Cato Ridge-Durban and Glencoe-Volksrust sections. Rectifiers completed for home railways comprised five additional units for the Tower Hill and Hendon substations of the L.P.T.B. An order was received from the London & North Eastern Railway for the complete rectifier equipment needed for the electrification of the line from Newcastle to South Shields. Six rectifiers giving 1,000 kW. at 630 volts will be installed in four remotely-controlled substations.

The company developed a new control gear for electric battery vehicles and provided equipment for several electric excavators, the most notable being for a stripping shovel of 11 cu. yd. capacity requiring a main driving motor of 750 h.p. and two hoisting motors each of 225 h.p. This equipment, the largest of its kind manufactured in this country, was to the order of Stewarts and Lloyds Limited.

Metropolitan Vickers Electrical Co. Ltd.

An order was received from the L.P.T.B. for complete Metadyne control equipment for 52 two-car trains for the Hammersmith & City line, London Transport. A trial train supplied previously to the Board had been in experimental use for some time and had proved satisfactory. A further order from London Transport was for the equipment of three metadyne battery locomotives each to have four motors and to weigh about 45 tons. Another English order received was from the Southern Railway and was for the modernisation of the electrical equipment of 26 three-coach trains.

Completed electric locomotives for the South African Railways (to separate order for 5 and 20) were shipped during the year. The first five are now in service. For the same system 46 motors of 300 h.p. for shunting locomotives were ordered. Complete electric locomotives—two in number—were shipped for the Polish State Railways, and 85 motors of 250 h.p. are being supplied to the Netherlands Railways for the Hague-Rotterdam-Hook of Holland section.

Good progress was made in the electrification of the Central Railway of Brazil. The first 10 three-coach trains were shipped in the middle of November and these are expected to be in regular service by March, 1937.

Developments of interest were reported in connection with electric battery vehicles and electric welding, both d.c. and a.c.

Exports of Railway Material from the U.K. in December

	Dec., 1936	Dec. 1935	Twelve Months Ending Dec., 1936	Twelve Months Ending Dec., 1935
	£	£	£	£
Locomotives, rail	103,601	188,013	1,303,438	876,703
Carriages and wagons	199,094	68,863	1,442,884	1,224,826
Rails, steel	192,958	65,659	1,295,579	907,362
Wheels, sleepers, fishplates and miscellaneous materials	111,730	95,208	1,457,737	1,840,977

Locomotive and rail exports included the following:—

	Locomotives Dec., 1936	Locomotives Dec., 1935	Rails Dec., 1936	Rails Dec., 1935
	£	£	£	£
Argentina	—	—	3,013	14,550
Union of South Africa	—*	—*	165,084	76,608
British India	8,319	5,290	14,841	26,264

* Figures not available

New Signalling for Newcastle and Edinburgh, L.N.E.R.—The L.N.E.R. has just completed plans for the modernisation of signalling at Newcastle-on-Tyne, and at the east end of Waverley station, Edinburgh. At Newcastle, where electro-pneumatic operation of signals and points is in use, the present No. 1 box, at the east end of the station, will be replaced by a new box having a control panel with thumb switches for working points and signals; point operation will continue to be electro-pneumatic, but three- or four-aspect colour-lights will replace the present semaphores. No. 2 box, in the centre of the station, and the Manors Junction box will be closed, but No. 3 (west end of station) will be retained as at present; the semaphore signals, however, will be replaced by colour lights. All lines will be track-circuited. At Edinburgh the existing mechanically-worked signal box at the east end of Waverley station is to be superseded by a new box, with 207 miniature levers immediately opposite on the south side of the yard. Abbeyhill Junction box, is to be closed. All lines between the east end of Waverly station and St. Margarets, and London Road Junction signal boxes will be track circuited, and multi-unit colour-lights with side and back lights are to be provided. Double-sided route indicators will be installed. Electrical train describers will operate between the new box and St. Margarets, and London Road Junction boxes. The resignalling at Waverley West, brought into use on October 11 last year, was described in our issue of November 27. The Edinburgh installation is to be carried out by the Siemens & General Electric Railway Signal Co. Ltd., and will be completed next year. The Newcastle installation will also be carried out by contract and will take about three years to complete; the latter work is being undertaken under the Government Assistance Scheme.

Closing Broadstone Station, Dublin

On Monday last, January 18, Broadstone station, the Dublin passenger terminus of the former Midland, Great Western Railway, was closed, and the passenger trains hitherto running to and from Broadstone have been transferred to Westland Row. Parcels and perishable traffic hitherto handled at Broadstone are now dealt with at Westland Row; horse-box and livestock traffic will be loaded and unloaded at Liffey junction. Broadstone was built about ninety years ago and represents a very fine example of railway architecture in Ireland.

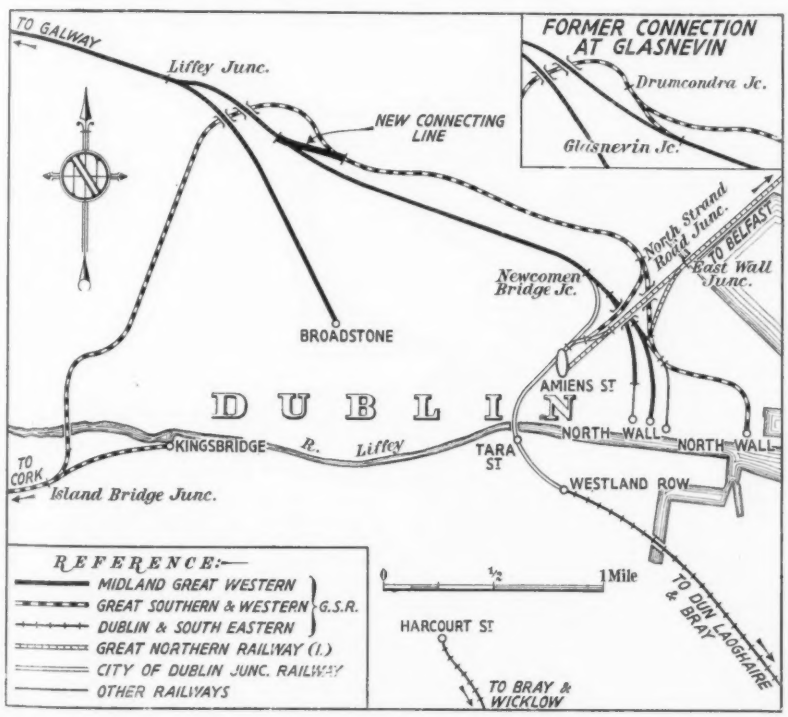
Formerly the local trains from Dublin to Cavan and the trains for the Meath and Athboy branches, which served the intermediate stations, had Broadstone for their terminus. For some time past these trains have been running to and from Amiens Street via Newcomen junction, and the arrangement was the precursor to the total closing of the old terminus, a project that has long been under consideration. When this change had been made, the main line trains which continued as formerly to Broadstone used only one platform and the former arrival platform and part of the station was converted into a garage to accommodate the increasing fleet of buses used by the growing road services of the company. Now that Broadstone is no longer a passenger station, the tracks at the platforms will be removed and the spaces available at present for dealing with trains will provide increased accommodation for extension of the bus depot.

It will be remembered that, prior to the construction of the North Wall extension line, the G.S. & W. trains ran over the M.G.W. line from Glasnevin junction to North Wall and to Dun Laoghaire pier. Between 1901 and 1905 a new line was built by the former Great Southern & Western Railway from Glasnevin junction to North Wall, also giving access to Amiens Street. This line runs almost parallel with the M.G.W. line from Liffey junction to North Wall. However, following the construction of the new line, the junction was taken up and the signal box at Glasnevin abolished the Great Southern trains to North Wall and Dun Laoghaire using their new line instead of the M.G.W. line.

Before the present change to Westland Row station was possible it was necessary to insert a new junction at Glasnevin, but in reverse direction to the former connection, so as to enable trains from the M.G.W. section to run to Amiens Street via the old Great Southern line and thus avoid crossing the canal lift bridge at Newcomen junction over which heavy engines could not travel. In addition, the gradients and curves over the new route are less severe.

Broadstone station is situated about ten minutes' walk from the tram line and has neither tram nor bus facilities. Passengers travelling to and from Westland Row, however, will have a decided advantage inasmuch as it is more conveniently situated, and both trams and buses pass the station to all parts of the city and suburbs.

The arrival of the last train on Saturday last, January 16, was broadcast from the signal box at Broadstone, and the signalman on duty, the driver, fireman, and guard of the Up Night Mail suitably expressed their feelings. Mr. Tom McGrane, who is 87 years of age, and has long retired from the position of guard on the Midland Great Western Railway, gave some particulars of his experience. Mr. John O'Dowd, Chief Operating Assistant to the Traffic Manager, in concluding the broadcast stated he was present for sentimental reasons, as he started his career at Broadstone, where fifty years ago his father ended his. He said that Broadstone would still play an important part, in an altered capacity, in the organisation of the Great Southern Railways. "It is being closed, but its traditions will remain and its spirit will survive for ever. Farewell Broadstone, Farewell to all your greatness." He then gave the Train-out-of-Section signal for the last train to arrive, and the answering bell in acknowledgment, which was distinctly heard, ended the broadcast.



Sketch plan of the railways around Dublin showing the new connecting line that has made it possible to close Broadstone station and transfer the traffic via Amiens Street to Westland Row

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NORTH CENTRAL WAGON CO. LTD.—In compliance with the regulations of the London Stock Exchange, particulars have been published of the North Central Wagon Co. Ltd., with a view to the establishment of a market in the ordinary shares. Incorporated in 1861, the business of the company and its main subsidiary (the Lincoln Wagon & Engineering Co. Ltd.) consists of financing the purchase by collieries and others of railway wagons on hire with the option of purchase. The company and its subsidiaries also provide facilities for the purchase of private cars and commercial and passenger vehicles under agreements for hire with option of purchase.

With a view to developing the road vehicle side of its business the company, in conjunction with the Lincoln company, acquired in June, 1934, the whole of the issued share capital of Consumer Credit Corporation Limited (incorporated in 1930). In October, 1934, Consumer Credit Corporation acquired a controlling interest in Southern Counties Car Finance Corporation Limited, of Brighton (incorporated in 1922), which has a valuable connection on the South Coast in the financing of road transport. The issued share capital of the North Central company consists of 250,000 6½ per cent. cumulative preference £1 fully paid shares and 1,500,000 ordinary shares of £1 each, 3s. a share paid. There is also a 4 per cent. debenture issue of £1,286,217.

Staff and Labour Matters

The Six-Hour Day Claim

Delegates, representative of the membership of the Associated Society of Locomotive Engineers and Firemen throughout the country, assembled in London yesterday, January 21, to consider the recently published findings of the Railway Staff National Tribunal in regard to the society's claim for the establishment of a six-hour day; for the cessation of the deduction of 1½ per cent. from earnings; for increased rates of payment for overtime, night duty, and Sunday duty; and for increased holidays with pay. The findings, which, as reported in our issue of January 8, were against all items of the claim, are not binding upon the parties, and the delegate conference of the trade union will vote on the question of acceptance of the findings. At the time of writing these notes no decision had been announced, and it is not unlikely that the discussions may last some days.

Changes in Railway Union Presidency

The present month has seen changes in the office of president of two of the railway trade unions. On January 1 Mr. Joseph Henderson, J.P., M.P., retired from the presidency of the National Union of Railwaymen and was succeeded by Mr. T. W. Griffith, J.P., who was elected at the union's annual conference which was held at Hull in July last. Mr. George H. Tyler vacated on January 1 the office of President of the Associated Society of Locomotive Engineers and Firemen and, on January 4 at the first meeting of the new executive committee of the society, Mr. W. J. Evans was appointed in his stead. A change in the presidency of the Railway Clerks' Association is also announced to take place. The executive committee of the association has appointed Mr. F. B. Simpson, M.P., who has been President for some years, to the post of Chief Assistant Secretary, which will become vacant at the end of May next, when Mr. George Lathan, M.P., is due to retire. Mr. Henderson, Mr. Tyler, and Mr. Simpson have all been active leaders of their respective unions, and all took an important part during the negotiations which resulted in the establishment of the new machinery of negotiation for railway staff, which came into operation on March 1, 1935.

Death of Mr. J. Compton, M.P.

The many railwaymen who knew him learned with regret of the death, on Monday last, January 18, of Mr. Joseph Compton, M.P. for the Gorton Division of Manchester. Mr. Compton was 55. Since the establishment of the agreed scheme of machinery for railway shopmen in 1927, Mr. Compton had been Chairman of the employees' side of the National Railway Shopmen's Council, and was deservedly popular with both sides of the council. As Assistant General Secretary of the National Union of Vehicle Builders, he was skilled in negotiations concerning wages and conditions of employment.

Road Transport Wages

When the Government committee which is considering the question of the regulation of wages and conditions in the road transport industry (goods) held a further sitting in London on Monday, January 18, the chair was occupied by Sir Gerald Bellhouse, in the absence of Sir James Baillie, who was indisposed. Evidence was submitted by the Joint Council for the Retail Distributive Trades, the constituent parties of which are the London Employers' Association, the Retail Distributors' Association, and the Transport and General Workers' Union. The council expressed the view that there was a large proportion of road transport workers in the retail distributive trades whose wages are not regulated by voluntary agreements, while many distributors outside their organisations are not conforming to the agreed level of wages and conditions. It was feared a continuance of that situation might jeopardise the existing agreements, especially in provincial towns.

The council very strongly urged that steps should be taken which would have the effect of making general, throughout the retail distributive trades, standards of wages for road motor drivers such as those which the members of the council had undertaken to observe. The joint council commented in detail upon the suggestions which had been made to the Government committee that the nature of the employment of motor drivers of the retail distributive trades is such as to make it impossible to regulate their minimum wages and working conditions. The council submitted that none of the difficulties mentioned "provides any insuperable barrier to steps being taken to make generally applicable minimum standards of wages and working conditions for motor drivers similar to those determined by the joint council or by some similar body which may be developed from it."

Evidence was given by the Allied Association of Bleachers, Dyers, Printers and Finishers on behalf of which it was stated that transport conditions vary so widely that codification of wage arrangements would produce widespread anomalies. The association expressed opposition to additional restrictions created by statutory obligation. It is urged that "in the interests of the community it is most undesirable that "C" Licence Holders should be 'tied' to the transport industry." The Woolcombing Employers' Federation and the Worsted Spinners' Federation gave evidence to similar effect. Evidence submitted by the Federation of Master Cotton Spinners' Associations Limited showed that machinery exists in the cotton industry for regulating rates of pay and conditions of service of motor drivers employed by member firms, and it was submitted that "nothing should be done by way of statutory provision to jeopardise that machinery."

On Tuesday, January 19, the Government committee received evidence from the Joint Parliamentary Committee of the Co-operative Congress. It was stated that the retail distributive societies covered by the organisation employed over 37,000 workers in transport operations, and that between 8,000 and 9,000 mechanically and electrically propelled vehicles are, at present, operated by various co-operative societies. Details were given as to the wage rates paid and it was submitted that, in the main, the wages and conditions compare "quite favourably" with those laid down by the National Joint Conciliation Board, although the classification of workers is different. It was stated that the Parliamentary Committee of the Co-operative Congress "is satisfied that an extension of the existing statutory regulation of wages for drivers of mechanically and electrically propelled vehicles is desirable in the public interest." Reasons were given in support of this argument and the extension to "C" Licence Holders of "reinforced machinery for statutory regulation of wages," etc., was recommended. Suggestions were submitted regarding the establishment of "appropriate machinery representing 'C' Licence Holders" and for the keeping of adequate records by all licence holders of wages and hours.

The National Union of Distributive and Allied Workers, representative of a total membership of 160,000, with an interest in transport almost wholly concerned with "C" licence holders, submitted a lengthy memorandum which included reasons why, in the opinion of the organisation, the extension of the existing statutory regulation of wages to cover all classes of motor goods vehicles, whether "A," "B," or "C" classification, is necessary. It was suggested that a conciliation board to settle wages and conditions of drivers of vehicles operated under "C" licences should be set up and be representative of the interests involved, and that there should be co-ordination between such a new board and the present National Joint Conciliation Board.

The Government Committee will meet in public again on February 4, and it will be observed from these notes, and from those published in previous issues, that already a mass of evidence expressing conflicting views of widely varying interests has been submitted to the committee, who, obviously, have before them an exceedingly difficult task in framing recommendations to be laid before the Ministers of Labour and Transport.

XUM

RAILWAY AND OTHER MEETINGS

Rohilkund and Kumaon Railway Co. Ltd.

The ordinary general meeting of the Rohilkund & Kumaon Railway Co. Ltd. was held on January 19 at 237, Gresham House, Old Broad Street, E.C.2., Sir Leonard L. Cohen, K.C.V.O., presiding in place of Lt.-Col. F. Gracey, R.E., Chairman and Managing Director, who was indisposed.

The Secretary, Lt.-Col. W. R. Izat, D.S.O., R.E., read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, read the speech prepared by Col. Gracey. There was, he said, little he could add to what was said in the report regarding the death of Sir Henry Burt, their late Chairman. For 18 years and until his death last October he devoted himself wholeheartedly to the interests of the company, and to his ability and wise guidance the great progress made during that period was largely due.

To fill the vacancy caused by the death of Sir Henry Burt, Lt.-Col. W. R. Izat, D.S.O., R.E., had been appointed a Director. Sir James Williamson would be appointed Secretary to the company in place of Lt.-Col. W. R. Izat. Sir James Williamson had retired from India and had been succeeded as Agent by Mr. J. D. Westwood. As Agent in India, Sir James had been instrumental in maintaining the prosperity of the company during the last seven years when most railways were struggling against adversity. His services would be retained in the London office.

According to the company's contract with the Secretary of State, the latter had the option of purchasing the company's property at the end of 1937 on giving 12 months' notice of his intention to do so. On November 18 the board was asked by the Secretary of State to discuss proposals for the company to continue undisturbed under existing contracts for a brief but unspecified period beyond 1942 (when the Secretary of State had another option to purchase) in return for an unspecified but substantial annual payment by the company to the Secretary of State, starting at the end of 1937. The board was unable to find in the informal suggestions any basis for discussion, and saw no prospect of entering into any arrangement which it could have conscientiously recommended the shareholders to consider. On December 23 the board was informed that the Secretary of State did not mean to exercise his option in 1937, so the contracts continued as at present until the end of 1942.

The Chairman (Lt.-Col. Gracey) had visited India last cold weather and had been very pleased with what he saw and heard. The shareholders had got a good property, which was well and economically managed. Concurrently with the advantages which accrued to shareholders, the area within which the company operated became a valuable asset to the State in the revenue which it produced, and in other ways too numerous to specify.

There were two main problems at present agitating Indian railways : motor competition and ticketless travel. The first was being kept in check by suitable concessions, the main idea being to prevent it developing sufficiently in any place to be a serious menace. While the concessions already granted appeared to have been effective in retaining and even increasing the company's traffic, it seemed doubtful if they would bring about an increase of earnings, and any further concessions would have to be very carefully scrutinised. The second problem was being dealt with by extra travelling ticket collectors, by check raids, and other means. The Government of India had tried to amend the law and make the method of dealing with ticketless passengers simpler, but so far without success.

A local question greatly affecting the company was the sugar cane traffic. It had grown prodigiously during the last few years, and the conundrum that had to be solved was how long it was likely to last, and how much development was necessary in rolling stock, engines, permanent way and other facilities so as to deal with it adequately, and at the same time have no redundancy.

The general results of the working of the joint undertaking for the year ended September, 1936, were again satisfactory, the gross earnings being Rs. 74·27 lakhs, which was 5·73 lakhs more than last year and created a record. There had been a slight falling off in the receipts from coaching traffic, and a small increase in the number of passengers carried. There was a very substantial increase in goods traffic, both in the tonnage carried and the receipts therefrom. The increase was mainly due to the development of the cane sugar industry, and the factories which had been established in the company's districts. The percentage of working expenses to gross earnings was 44·39, rather lower than last year.

The company's share of the net earnings of the joint undertaking amounted to £143,620, to which must be added the surplus profits of the Lucknow Bareilly Railway (£11,673) and gain by exchange (£874), making a total of £156,167, against £136,792 for the previous year, or an increase of £19,375. After making the necessary adjustments on account of debenture interest, preference and interim dividends, and providing £9,120 for the Secretary of State's share of surplus profits, the amount to be dealt with was £59,581. Out of that sum the directors proposed to pay a final dividend of 6 per cent. with a bonus of 5 per cent. amounting to £38,316. This, together with the interim dividend and bonus of 7 per cent. already paid, would make a total distribution of 18 per cent. for the year—an increase of 2 per cent. on last year's distribution. The board had placed a sum of £15,000 from net earnings to a contingency fund, which must certainly be provided for in connection with the winding up of the company when the Secretary of State decided to terminate the contract. The carry-forward to next year would then be £21,264 10s.

The reports for the current year were so far satisfactory, and their thanks were due to the Agent and staff in India and in the London Office for the excellent work they had done during the year.

The motion by the Chairman " that the report of the directors, dated January 9, 1937, together with the audited statement of accounts and balance sheets for the year ended September 30, 1936, be, and they are hereby received, approved and adopted," was seconded by the Rt. Hon. Lord Meston, and carried unanimously.

Mr. W. Stantiell seconded the Chairman's motion " that the final dividend of £6 per cent. and a bonus of £5 per cent. for the half-year ended September, 1936, on the ordinary stock of the company, subject to income tax, be, and the same is hereby declared, making with the ad-interim dividend of £4 per cent. and a bonus of £3 per cent. paid on July 27, 1936, a total dividend of £18 per cent. for the year ended September 30, 1936." This was adopted unanimously.

The Rt. Hon. Lord Meston, K.C.S.I., moved, and Mr. W. Stantiell seconded, the re-election of Sir Leonard L. Cohen as a Director of the company, which was unanimously approved.

The re-election of the Rt. Hon. Lord Meston as a Director was proposed by the Chairman, seconded by Lt.-Col. W. R. Izat, and carried unanimously.

Mr. C. V. Bliss moved the re-election of the auditors, Messrs. Gerard Van de Linde & Son, and Messrs. Sissons, Bersey, Gain, Vincent & Company, at a remuneration respectively of 45 guineas per annum. Mr. J. F. Dent seconded the proposal, which was carried unanimously.

Mr. C. V. Bliss moved a vote of thanks to the Chairman and Directors, also to the Agent and the staff in India and Englaud for their services.

The resolution was seconded and carried, and the Chairman concluded, " I shall have much pleasure in having that resolution transmitted to India, and on behalf of the staff I thank you for your expression of appreciation. As regards the board we are entirely, as always, your devoted servants."

XUM

NOTES AND NEWS

Home Railway Dividend Dates.—The dates on which the respective final dividends of the four main line railway companies are expected to be announced are: February 8, Southern; February 10, L.M.S.R. and Great Western; February 19, L.N.E.R.

Deeside Bus Service Taken Over.—On Friday last, January 15, Crosville Motor Services Limited took over Crowthers Bus Service of Connah's Quay, the last remaining privately-owned Flintshire bus undertaking on Deeside.

Loans to Leopoldina & Great Western of Brazil Railways.—A Reuters message from Rio de Janeiro states that President Vargas, in a message to the Chamber of Deputies on January 14, asked for authority to grant loans of 23,000 contos and 12,000 contos to the Leopoldina and Great Western of Brazil Railways, respectively.

St. Paul's Station to be Blackfriars.—From February 1 the Southern Railway is renaming its St. Paul's station as Blackfriars. This name will therefore accord with that of the District Line station at the same place. The name "St. Paul's" thus left free is to be allotted by the London Passenger Transport Board to the new Central London Line station that is now nearing completion to replace the present Post Office station.

French Railwaymen's 40-hour Week Bill.—This Bill was signed by President Lebrun on January 18, on presentation by the Minister of Public Works in the Council of Ministers. The Bill had previously been finally approved by the railway companies and by the National Economic Council. It is expected that it will have the effect of re-absorbing the unemployed and that 60,000 new men will be taken on; it will come into force on May 21.

Cordoba Central Railway Purchase.—It is announced by Reuters that, owing to pressure of business, the Argentine Government is not asking the present extraordinary session of Congress to deal with the Bill for the purchase by the State of the Cordoba Central Railway. The Bill will be postponed to the ordinary session of Congress, which will probably open in May. An article on page 140 outlines the history of the railway and of the present purchase negotiations.

Sir John Aspinall's Funeral Arrangements.—For Sir John Aspinall, whose death we record on page 147, and to whom reference is made in our editorial on page 132, there will be a Requiem Mass at St. Dunstan's, Woking (near the station), at 11 a.m. today (Friday), followed by interment at St. Edward's, Sutton Park. (Train leaves Waterloo at 10.4 a.m.) There will also be a Requiem Mass in the Holy Souls' Chapel at Westminster Cathedral at 11.30 a.m., at which seats are being reserved for members of the Institutions of Civil and Mechanical Engineers.

Rebuilding Royal Waiting Room at Victoria, Southern Railway.—The Royal waiting room at Victoria station, Southern Railway, is being rebuilt in readiness for the Coronation. A reception room is to be provided, and an improved sitting room. The room faces No. 1 platform, where the boat trains start.

Fire in Kowloon-Canton Express.—A disastrous fire broke out in the third class coaches of an express from Kowloon to Canton on January 16. Some 70 or 80 passengers are believed to have lost their lives directly due to the outbreak or to jumping from the train, which was travelling at speed; a further 40 were injured. It is believed that the fire was a case of incendiarism, but the inquiry has not yet been held.

Harbours, Piers, and Ferries (Scotland) Bill.—A Bill, under the above title, "to make provision for the acquisition and construction by local authorities of harbours, piers, ferries, and boat-slips in Scotland, for the construction of new works connected therewith, and for the fixing and revision of dues thereat and at certain inland navigations, and for other purposes relating to the matters aforesaid," was presented on Wednesday (January 20) by Mr. Secretary Elliot. It was to be read a second time yesterday.

London Electric Finance Corporation Stock.—Subscriptions on January 16 to the issue of £9,650,000 of 2½ per cent. guaranteed debenture stock of the London Electric Transport Finance Corporation Limited, at the price of 92½ per cent., were satisfactory. Applications for amounts up to £25,000 received allotment in full, and those in excess of that figure obtained 88 per cent. Principal and interest are guaranteed by the Treasury. The issue is the second made by the corporation to finance the £40,000,000 scheme for the improvement of London transport facilities.

The Coronation Express.—The L.N.E.R. announces that the timings of the new Coronation streamlined trains, which are to begin running in July, have now been tentatively arranged. The down train will leave King's Cross at 4.0 p.m. and arrive in Edinburgh at 10.0 p.m., calling at York at 6.42; important connections will be made at York from Leeds, Harrogate, Sheffield, and other West Riding towns and Hull, giving these stations improved services to Scotland. In the reverse direction the train will leave Edinburgh at 4.30 p.m., call at Newcastle at 6.35, and arrive at King's Cross at 10.30 p.m. The average speed in both directions will be 65.38 m.p.h. For the streamlined trains between the West Riding and London, which will be introduced in the autumn, the times will be approximately as follow, but slight alterations may be found necessary: Bradford, dep., 11.10 a.m.; Leeds, dep., 11.31 a.m.; King's Cross, arr., 2.15 p.m., a Leeds-London average of 68 m.p.h. King's Cross, dep., 7.10 p.m.; Leeds, dep., 9.53 p.m.; Bradford, arr., 10.15 p.m.; an average of 68·5 m.p.h. to Leeds.

Beira Railway Debenture Issue.—The recent issue at par of £2,000,000 5 per cent. first debenture stock of the Beira Railway Company was quickly over-subscribed. It enables the 5 per cent. prior lien rentcharge to be redeemed as well as the £1,771,170 of 6½ per cent. debenture stock still outstanding, and will result in an immediate reduction of £64,100 per annum in fixed charges.

Indian Railway Officer Required.—The directors of the Madras & Southern Mahratta Railway Company invite applications for the post of Assistant Transportation Superintendent (Power) for service in India in April, 1937. The qualifications required are: Age, 24 years; applicant to be of European domicile with at least two years' practical experience, including periods in a locomotive running shed and on the footplate, and preferably with experience of diesel engines. The commencing salary is Rs. 350 per mensem. Applications are to be made by letter to the Secretary of the company, 25, Buckingham Palace Road, Westminster, S.W.1. The official intimation appears on page 163.

The Armstrong Whitworth Locomotive Plant at Scotswood.—According to statements that have appeared in the columns of the daily press, the locomotive building works of Sir W. G. Armstrong Whitworth & Co. (Engineers) Ltd., at Scotswood, Newcastle, are shortly to be taken over by Vickers Limited, together with the control of the business, and used for Admiralty purposes in connection with the national defence scheme. Orders at present in hand include a contract, placed by the L.M.S.R. in 1935, for 227 locomotives, rather more than one-third of which has already been completed. The activities of the works also cover the design and construction of diesel locomotives and railcars, and important contracts for abroad have, from time to time, been executed. The capital of the concern is £1,500,000, which is controlled by the Armstrong Whitworth Securities Co. Ltd.

Colour-Light Signalling at Galashiels.—The L.N.E.R. has recently carried out an extensive colour-light signalling scheme at Galashiels and the vicinity. A new signal box has been brought into use at Galashiels station, from which are controlled the signals, points, etc., on the area between Kilnknowe junction and Selkirk junction. The running signals, which are of the searchlight type, have two, three, and four aspects. Signals and points at Kilnknowe junction and Selkirk junction

are electrically operated by thumb switches. The lines are track circuited and the positions of the trains are indicated on an illuminated diagram. The scheme was prepared to meet the requirements of Mr. R. Gardiner, Superintendent, Southern Scottish Area, L.N.E.R., and the work carried out by the company's staff to the instructions of Mr. W. A. Fraser, Engineer, L.N.E.R. (Scotland), under the immediate supervision of Mr. A Moss, Signal and Telegraph Engineer, Scotland.

Institution of Railway Signal Engineers Summer Meeting.—The proposed 1937 annual summer meeting of the I.R.S.E., which is to take the form of visits to railway signalling installations in Stockholm and Copenhagen, combined with a voyage on a cruising liner, has already received very considerable support. The President-elect and Mrs. Proud have already spent some 24 hours on the liner concerned during one of its journeys up the English Channel, and are, therefore, in a position to answer questions which members or ladies contemplating attendance at this meeting may care to ask. It is possible that, at the conclusion of the next meeting of the I.R.S.E., Wednesday, January 27, lantern slides of the liner and the cities will be shown to any members interested.

The Manifold Valley Light Railway Site.—The L.M.S.R. has now sold the two 2 ft. 6 in. gauge 2-6-4 tank locomotives Nos. 1 and 2, named *E. R. Calthrop* and *J. B. Earle*, respectively, of the former Manifold Valley Light Railway, to the contractor who is removing the permanent way. The line was closed for all traffic after March 10, 1934. Recently the L.M.S.R. has presented the site and bridge superstructure to the Staffordshire County Council as it provides the only means of access from the south to the beautiful Manifold Valley. The local rural council is now endeavouring to persuade the County Council to build a road over the course of the railway, which, however, it is to be hoped will be maintained as a pathway for ramblers only.

British and Irish Traffic Returns

GREAT BRITAIN	Totals 2nd Week			Totals to Date.		
	1937	1936	Inc. or Dec.	1937	1936	Inc. or Dec.
L.M.S.R. (6,914½ mls.)	£	£	£	£	£	£
Passenger-train traffic...	367,000	361,000	+ 6,000	733,000	723,000	+ 10,000
Merchandise, &c. ...	476,000	452,000	+ 24,000	924,000	910,000	+ 14,000
Coal and coke ...	283,000	299,000	− 16,000	564,000	613,000	− 49,000
Goods-train traffic ...	759,000	751,000	+ 8,000	1,488,000	1,523,000	− 35,000
Total receipts	1,126,000	1,112,000	+ 14,000	2,221,000	2,246,000	− 25,000
L.N.E.R. (6,332 mls.)						
Passenger-train traffic...	249,000	242,000	+ 7,000	496,000	488,000	+ 8,000
Merchandise, &c. ...	322,000	324,000	− 2,000	630,000	641,000	− 11,000
Coal and coke ...	269,000	282,000	− 13,000	507,000	554,000	− 47,000
Goods-train traffic ...	591,000	606,000	− 15,000	1,137,000	1,195,000	− 58,000
Total receipts	840,000	848,000	− 8,000	1,633,000	1,683,000	− 50,000
G.W.R. (3,746½ mls.)						
Passenger-train traffic...	167,000	163,000	+ 4,000	327,000	320,000	+ 7,000
Merchandise, &c. ...	186,000	180,000	+ 6,000	369,000	356,000	+ 13,000
Coal and coke ...	119,000	126,000	− 7,000	234,000	248,000	− 14,000
Goods-train traffic ...	305,000	306,000	− 1,000	603,000	604,000	− 1,000
Total receipts	472,000	469,000	+ 3,000	930,000	924,000	+ 6,000
S.R. (2,153 mls.)						
Passenger-train traffic...	252,000	241,000	+ 11,000	501,000	484,000	+ 17,000
Merchandise, &c. ...	55,000	57,500	− 2,500	108,000	112,500	− 4,500
Coal and coke ...	36,000	42,500	− 6,500	67,000	79,500	− 12,500
Goods-train traffic ...	91,000	100,000	− 9,000	175,000	192,000	− 17,000
Total receipts	343,000	341,000	+ 2,000	676,000	676,000	—
Liverpool Overhead ... (6½ mls.)	1,218	1,175	+ 43	2,491	2,444	+ 47
Mersey (4½ mls.) ...	4,475	4,358	+ 117	9,157	8,784	+ 373
*London Passenger Transport Board ...	550,700	532,300	+ 18,400	16,251,900	15,792,000	+ 459,900
IRELAND						
†Belfast & C.D. pass. (80 mls.)	1,781	1,994	− 213	4,115	4,509	− 394
,, ,, goods	462	541	− 79	937	1,124	− 187
,, ,, total	2,243	2,535	− 292	5,052	5,633	− 581
Great Northern pass. (543 mls.)	7,700	7,800	− 100	16,050	16,100	− 50
,, ,, goods	9,350	10,500	− 1,150	17,150	20,000	− 2,850
,, ,, total	17,050	18,300	− 1,250	33,200	36,100	− 2,900
Great Southern pass. (2,075 mls.)	26,614	26,986	− 372	54,439	55,110	− 671
,, ,, goods	51,362	46,990	+ 4,372	94,083	94,239	− 156
,, ,, total	77,976	73,976	+ 4,000	148,522	149,349	− 827

† 3rd week. * 29th week.

British and Irish Railways Stocks and Shares

Stocks	Highest 1936	Lowest 1936	Prices Jan. 20, 1937	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	64¼	45½	62½	−1
5% Con. Prefce ...	126½	116¾	126	—
5% Red. Pref. (1950)	113	108½	111½	—
4% Deb.	119½	110½	111	−1½
4½% Deb. ...	121	114	117½	—
4½% Deb. ...	129	121	124½	—
5% Deb.	141	134	134½	−2
2½% Deb. ...	79⅛	74	75½	—
5% Rt. Charge ...	136½	130	132	−1½
5% Cons. Guar. ...	135¼	127¾	132	−1
L.M.S.R.				
Ord.	35⅝	17	32¼	−1¼
4% Prefce. (1923)	83	52½	79½	−1
4% Prefce. ...	92¾	81	89	−1½
5% Red. Pref. (1955)	109¼	103¼	107	—
4% Deb.	111¾	105 9/16	105	−1½
5% Red. Deb. (1952)	119⅝	115½	116½	—
4% Guar. ...	106¾	101⅝	101	−1½
L.N.E.R.				
5% Pref. Ord. ...	14	9	11	−½
Def. Ord. ...	7¼	4¾	5½	−¼
4% First Prefce.	79¼	55¼	77	−1½
4% Second Prefce.	31⅞	18¼	27	−1½
5% Red. Pref. (1955)	100½	77¾	100	—
4% First Guar. ...	104½	98¾	99*	−3
4% Second Guar.	99	90	94*	−3½
3% Deb.	85¾	79	80½	−2
4% Deb.	109¾	104½	105	−1½
5% Red. Deb. (1947)	116¼	110½	112½	—
4½% Sinking Fund Red. Deb.	111½	107½	109½	—
SOUTHERN				
Pref. Ord. ...	98¾	82½	98	—
Def. Ord. ...	27⅛	20⅛	25	−1½
5% Prefce. ...	120¾	118½	124½	−½
5% Red. Pref. (1964)	119¾	115¼	117½	—
5% Guar. Prefce.	136	129½	132	−1½
5% Red. Guar. Pref. (1957)	120	115¾	117½	—
4% Deb.	117 5/16	109½	110	−1½
5% Deb.	140	134	135½	—
4% Red. Deb. 1962–67	116½	110	112½	—
BELFAST & C.D.				
Ord.	9	4½	5	—
FORTH BRIDGE				
4% Deb.	107	105	104½	—
4% Guar. ...	107 3/16	104	104½	—
G. NORTHERN (IRELAND)				
Ord.	19½	9¾	12	—
G. SOUTHERN (IRELAND)				
Ord.	63	41	52	−6½
Prefce.	65	46	60	−1
Guar.	97¼	81	94½	+1
Deb.	99¾	83¼	93½	−½
L.P.T.B.				
4½% "A" ...	127¾	121	121½	−1
5% "A" ...	138¼	133½	133½	−1
4½% "T.F.A." ...	111½	108⅛	108	−1
5% "B" ...	131¾	123¾	123½	−1
"C" ...	112½	93	96	−2
MERSEY				
Ord.	40¾	23	39½	−2
4% Perp. Deb. ...	103	98	100*	−1
3% Perp. Deb. ...	78	74⅝	76½*	−1
3% Perp. Prefce.	68⅞	63¼	67½	—

* ex dividend

CONTRACTS AND TENDERS

Ransomes & Rapier Limited has received an order from Wagon Repairs Limited for a 30-ton electrically-driven wagon traverser for installation at Cardiff, similar to a traverser previously supplied by the same firm to this company.

Beyer, Peacock & Co. Ltd. has received an order from the San Paulo Railway for five 5-ft. 3-in.-gauge 2-6-0 tank locomotives, which are to be similar in every respect to the seven at present under construction by this firm for the same railway.

The Acme Manufacturing Co. Ltd. has received an order from the Indian Stores Department for 222 sets of metal sliding window frames, to a total value of Rs. 20,813; delivery free G.I.P. Railway, Matunga.

The South African Railways & Harbours Administration has recently placed the following orders to the values given :—

Ibbotson Bros. & Co. Ltd., heel and crossing bolts (Order No. B 8602, total price £1,552 12s. 8d.).

Kleineisin u Schraubenfabrik, Steel, G.m.b.H., gauge clips (Order No. B 8663/2, total price £58 15s.).

Laminoir et Boulonneries du Ruan, clips, bolts and nuts (Order No. B 8663/1, total price £51 5s.).

Barrow Hæmatite Steel Company, fishplates (Order No. B 8601/1, total price £1,745 14s.).

Schmedag A.G., fishbolts and nuts (Order No. B 8428/3, total price £343 2s. 5d.) and fishbolts and nuts (Order No. B 8601/2, total price £205).

The Madras & Southern Mahratta Railway Administration has placed the following orders to the inspection of Messrs. Rendel, Palmer & Tritton :—

Skoda Works Limited, eight locomotive crank axles.

Soc. Commerciale d'Ougree, 3,750 pairs of fishplates for BS 90 BH rails, and 20,000 bearing plates.

Geo. Turton Platt & Co. Ltd., 52,000 Stuart's keys and 52,000 wedges.

Stahl Union Export G.m.b.H., 26,800 fishbolts.

S.A. de Forges de la Providence, 29,000 tie bars for pot sleepers.

Skoda Works, through J. O'Hara Murray, has received an order from the Assam-Bengal Railway Administration to the inspection of Messrs. Rendel, Palmer & Tritton for 152 pairs of wagon wheels and axles.

W. Nicholson & Son is reported to have received an order from the L.M.S.R. for the concourse and roof coverings required at the Leeds New station.

The Indian Stores Department has placed orders with Heatley & Gresham Limited and with Britannia Batteries Limited, each for 10 sets of lead acid train lighting cells.

Whitelegg & Rogers Limited has recently received orders for two Ajax patent steam-operated firedoors, required for two locomotives under construction by Robert Stephenson & Co. Ltd. for the Bengal-Nagpur Railway, and two Ajax patent air-operated firedoors, required for two spare boilers for the Canton-Hankow Railway, also under construction by Robert Stephenson & Co. Ltd.

British Locomotives for Egypt

The Egyptian State Railways Administration has placed orders with the North British Locomotive Co. Ltd. for 18 coal-fired and 8 oil-fired 4-4-0 locomotives at £5,983 and £6,183 respectively, and with the Sentinel Waggon Works Limited for two coal-fired and two oil-fired locomotives at £7,563 and £7,789 respectively. The Sentinel locomotives are to be of a special type having locomotive pattern boilers, the 2-A-A-2 wheel arrangement, and individual axle drive from a geared engine suspended from each axle. They will weigh approximately 53 tons each and will be fitted with six-wheeled tenders of the Egyptian State Railways standard type.

The Crown Agents for the Colonies have recently placed the following orders :—

Ingersoll-Rand Co. Ltd., Air compressor and drills.

Spencer, Hopwood Limited, Boilers.

Chloride Electrical Storage Co. Ltd., Cell spares.

Staveley Coal & Iron Co. Ltd., C.I. pipes.

Redler Patents, Coal elevating equipment.

Eyre Smelting Co. Ltd., Copper ingots.

Spencer Wire Co. Ltd., Copper wire.

Nobels Explosives Limited, Detonators.

New Pelapone Engine Co. Ltd., Diesel engines.

Guest Keen & Nettlefolds Limited, Dogspikes and mild steel screwed bars and couplings.

General Electric Co. Ltd., Electrical and telephone materials.

Norris, Henty & Gardners, Gardner engines and spares.

Ruston & Hornsby Limited, Generator spares.

T. Bolton & Sons Ltd., H.D. cadmium copper wire.

J. Woodhead & Sons Ltd., Laminated springs.

J. Baker & Bessemer Limited, Locomotive tyres.

Albion Motors Limited, Lorry and trailer chassis.

Whitehead Iron & Steel Co. Ltd., Mild steel bars.

P. & W. MacLellan Limited, Mild steel plates, steel angles and bars.

J. Stirk & Son Ltd., Patent rail planer.

Phosphor Bronze Co. Ltd., Phosphor bronze.

Stewarts and Lloyds Limited, Pipe fittings.

Bullers Limited, Porcelain insulators.

Bayliss, Jones & Bayliss Limited, Permanent way bolts.

C. Richards & Sons Limited, Permanent way bolts.

United Steel Companies Ltd., Rails and fishplates.

Butler Machine Tool Co. Ltd., Single head shaper machine.

Horsehay Co. Ltd., Single-track railway bridge spans.

Barrow Hæmatite Steel Co. Ltd., Steel bearing plates.

Steel Company of Scotland Ltd., Steel tyres.

A. & J. Main & Co. Ltd., Steelwork.

Ferguson, Pailin Limited, Substation switchgear.

Anderston Foundry Co. Ltd., Switches and crossings.

Darlington Railway Plant & Foundry Co. Ltd., Switches and crossings.

British Insulated Cables Limited, Telephone cables.

Automatic Telephone & Electric Co. Ltd., Telephone exchange apparatus.

Creed & Co., Teleprinters.

The English Electric Co. Ltd. has received an order from the Indian Stores Department for one rectifier complete with transformer and switchgear, to a total value of Rs. 23,787, delivery free Allahabad.

The Associated Equipment Co. Ltd. has received orders from the London Passenger Transport Board for 175 Regent oil-engined passenger vehicles and from the Northern General Transport Co. Ltd. for 35 oil-engined Regal passenger vehicles.

The Chinese Government Purchasing Commission has placed the following orders to the inspection of Messrs. Fox & Mayo: Butler Machine Tool Co. Ltd., one 26-in. super shaping machine required for the Canton-Hankow Railway; and Matheson & Co. Ltd., 249 tons of steel reinforcement bars and 1,300 steel I beams required for the King-Kan Railway.

Forthcoming Events

Jan. 22 (*Fri.*).—Association of Glasgow Students of Inst. of Civil Engineers, at the University, Edinburgh, 7 p.m. "Railway Work in North China," by Mr. W. Leitch.

Institute of Transport (Leeds Graduate), at City Transport Department, 7 p.m. "The Saturation Point of Progress in Transport," by Mr. H. Mann.

Institute of Transport (Manchester-Liverpool) at Central Library, Manchester, 6.30 p.m. "Grain-Handling Equipment at Bahia Blanca," by Mr. J. Rowlands. "Phosphate-Handling Plant at Nauru Island," by Mr. C. Howard.

Jan. 25 (*Mon.*).—Institute of Welding (Teesside), at Cleveland Scientific Inst., Corporation Road, Middlesbrough, 7.30 p.m. "Residual Stresses and their Effect in Welding," by Mr. H. Martin.

Jan. 26 (*Tues.*).—Institute of Transport (Birmingham Graduate), at Imperial Hotel, 6.30 p.m. "Goods Transport by Road—the Contractor's Viewpoint," by Mr. F. Harrup.

Institute of Transport (Bristol), at the University, 6 p.m. Visit of the President.

Institution of Locomotive Engineers (Manchester), at 36, George Street, 7 p.m. "Locomotive Feed Water Treatment," by Mr. J. Hancock.

L.N.E.R. (Newcastle - Sunderland) Lecture and Debating Society, at Sunderland, 7 p.m. "Organisation," by Mr. L. Ballan.

L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 6.45 p.m. "The Construction of a Railway Carriage," by Mr. W. Brown.

Permanent Way Institution (Scottish), at Royal Technical College, George Street, Glasgow, 7.30 p.m. Annual Meeting.

Jan. 27 (*Wed.*).—Institution of Locomotive Engineers (London), at Inst. of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. "The Development of the Locomotive Turntable," by Mr. J. Wilkins.

Institution of Railway Signal Engineers, at Inst. of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. "The Manufacture of Gantries and Brackets," by Messrs. A. Birchenhough and J. Wright.

L.N.E.R. (Darlington) Lecture and Debating Society, at North Road Inst., 7.30 p.m. Short Papers.

Jan. 29 (*Fri.*).—L.N.E.R. Stratfordians' Association, at Great Eastern Hotel, Liverpool Street, London, E.C.2, 7 for 7.15 p.m. Re-Union Dinner.

Railway Students' Association (Edinburgh), at Goold Hall, St. Andrew Square, 7.30 p.m. "Power and Progress—Leaves from a Yard Master's Note Book," by Mr. J. Ellett.

Jan. 30 (*Sat.*).—Permanent Way Institution (London), at Inst. of Civil Engineers, Great George Street, S.W.1, 2.30 p.m. Annual Winter Meeting. Annual Winter Dinner, at Charing Cross Hotel, W.C.2, 6.30 p.m.

OFFICIAL NOTICES

London and North Eastern Railway

NOTICE IS HEREBY GIVEN that the Directors have fixed 28th January, at the close of business, as the date for striking the Balances of the Company's Guaranteed, Preference and Ordinary Stocks. Final Dividends declared for the year ended 31st December, 1936, will be payable only to the Stockholders whose names are registered in the books of the Company on the date so fixed.

Deeds of Transfer should, therefore, be lodged with the Registrar of the Company at Hamilton Buildings, Liverpool Street Station, London, E.C.2, before 5 p.m. on 28th January.

By Order,
JAMES McLAREN,
Secretary.

Marylebone Station,
London, N.W.1.
18th January, 1937.

ENGINEER, 37, Public School, Apprenticeship Railway Loco. Works, subsequent experience Factory Management, Costing, Office Organisation and Technical Sales, seeks position in Engineering or similar concern where his experience would be of value.—Box No. 14, c/o THE RAILWAY GAZETTE, 33, Tothill Street, Westminster, S.W.1.

The Madras & Southern Mahratta Railway Company Limited.

THE Directors of the above-named Company invite applications for the post of Assistant Transportation Superintendent (Power) for service in India in April, 1937.

The qualifications required are as follows:—
Age—24 years.
Applicant to be of European Domicile with at least two years' practical experience, including periods in a Locomotive Running Shed and on the footplate, and preferably with experience of Diesel Engines.
Commencing salary—Rs. 350 per mensem, in scale Rs. 350—25—450 and Rs. 500 per mensem in the 7th year of service. In addition, Overseas Pay as follows:—
1st to 4th year of service—Rs. 150 per mensem.
5th to 7th year of service—£15 per mensem.
8th to 11th year of service—£25 per mensem.
12th year onwards—£30 per mensem.
Leave—According to Rules.
Terms—Subject to a strict medical examination by the Company's Consulting Physician, a three years' agreement in the first instance, a first class free passage to India, and home again on satisfactory termination of agreement, which is extensible by mutual consent. Employees are required to subscribe one month's pay yearly to the Company's Provident Fund, and to those of over five years' service, a bonus equal to their contribution is credited, both bonus and contribution accumulating at compound interest until retirement.
Applications (by letter only) giving full particulars of general and technical education and practical experience in chronological order, stating age, whether married or single, together with copies only of testimonials, should be forwarded as soon as possible, and in any case not later than 15th February, 1937, addressed to:—

The Secretary,
Madras & Southern Mahratta
Railway Co. Ltd.,
25, Buckingham Palace Road,
Westminster, S.W.1.

19th January, 1937.

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite Tenders for:—
15 BOILERS FOR LOCOMOTIVES—BROAD GAUGE,
viz.,
Five for 2-8-0 Locomotives "DS" type;
Ten for 0-6-0 Locomotives "VZ" type.
Specification and Form of Tender can be obtained at the Company's Offices, 25, Buckingham Palace Road, Westminster, London, S.W.1.
Fee ONE GUINEA, *which will not be returned*
Tenders must be submitted not later than 2.00 p.m. on TUESDAY, 16TH FEBRUARY, 1937.
The Directors do not bind themselves to accept the lowest or any Tender and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
G. W. V. DE RHE PHILIPE,
Secretary.

RAILWAY AND OTHER REPORTS

Great Northern Railway (Ireland).—The board has resolved, subject to audit, to recommend to the proprietors the payment of a final dividend of £2 per cent. (less income tax) on the consolidated 4 per cent. guaranteed stock for the year ended December 31, 1936. The directors regret that the improvement in the total net income has not been sufficient to permit of the payment of dividends on the preference and ordinary stocks.

Beira Railway.—The accounts for the year ended September 30 show that gross revenue amounted to £801,352, an increase of £31,464, and working expenditure (including depreciation) to £374,171, an increase of £35,271, leaving a surplus of £427,181, which is £3,807 lower than that for 1934–35. Net profits, after interest, sinking fund charges and a reserve for income tax, amount to £160,800, against £166,335. The directors recommend a dividend of 1s. 8d. a share, allocate £70,000 to reserve, and propose to carry forward £33,982, against £30,682 brought in. For the previous year the dividend was 1s. 6d. a share.

Glyn, Mills & Co.—From the 105th statement of assets and liabilities as at December 31, 1936, of this well-known private bank, the soundness of its financial position is again clear. The proportion of quickly realisable assets to the deposits of £41,039,207, which reach an exceptionally high figure, is 83·8 per cent. There is, however, considerable variation from the figures of the previous year in the amounts for some of the different classes of assets. Cash is about the same, namely, £5,938,384, as against £5,956,185; balances with other banks and cheques in transit have risen from £2,195,723 to £3,244,597; bills discounted from £542,004 to £662,360; and money at call and short notice from £8,733,300 to as much as £14,170,100. Investments, on the other hand, stand at £10,403,118, against £11,879,161, including British Government securities of £9,478,250, against £10,903,646. Advances to customers, &c., have fallen from £10,014,218 to £7,750,649. Total assets are £46,113,112, against £41,594,173. The total capital authorised and issued is £1,060,000, and the reserve fund remains at £530,000.

Midland Railway Company of Western Australia.—Gross traffic receipts (in Australian currency) for the year ended June 30, 1936, amounted to £161,371, an increase of £1,797 in comparison with the previous year. In the working expenses of £74,161 there was an increase of £3,539, so that net receipts were £1,742 lower, at £86,730. Working expenses were 46·25 per cent. of gross receipts, as against 44·56 per cent. in the previous year. After including £27,292 brought forward, and transferring £3,000 to taxation reserve and £35,000 (against £30,000) to depreciation and renewals account, and paying interest (£5,723) on the 4½ per cent. first mortgage debenture stock, there remains a balance of £59,104, out of which the sum of £29,618 is appropriated for interest on the second mortgage cumulative income debenture stock at 5 per cent. for the year, leaving £29,486 to be carried forward. A sum of £52,004 has been charged to depreciation and renewals account for expenditure during the year, in addition to ordinary maintenance, on repairs, renewals of bridges, rails, sleepers, reballasting and rolling stock. £3,810 first mortgage debenture stock was redeemed and cancelled during the year, reducing the amount outstanding at June 30, 1936, to £125,555. Since that date a further £1,277 stock has been acquired for redemption.

Midland Bank Limited.—The directors report that, full provision having been made for all bad and doubtful debts, the net profits for the year 1936 amounted to £2,467,894, which, with £467,447 brought forward, makes £2,935,341, out of which the following appropriations amounting to £1,519,129 have been made: To interim dividend for the half-year ended June 30, 1936, at the rate of 16 per cent. per annum, less income tax, £869,129; to reduction of bank premises account, £350,000; to reserve for future contingencies, £300,000; leaving £1,416,212 from which the directors recommend a dividend payable February 1 next, for the half-year ended December 31, 1936, at the rate of 16 per cent. per annum, less income tax, £869,129, and a balance to be carried forward of £547,084. For 1935 the net profit was £2,353,098, the dividend was 16 per cent., and the allocations were: To reduction of bank premises, £300,000, to reserve for contingencies, £250,000, centenary bonus to staff, £200,000, bank clerk's orphanage, £20,000, and centenary bonus on paid-up capital, £220,844.

Forthcoming Meetings

Jan. 26 (*Tues.*).—**Bengal & North Western Railway Co. Ltd.** (Ordinary General), Winchester House, Old Broad Street, E.C., at 12 noon.

Jan. 26. (*Tues.*).—**Midland Bank Limited** (Ordinary General), Southern House, Cannon Street, E.C.4, at 12 noon.

Jan. 28 (*Thurs.*).—**National Provincial Bank Limited** (Annual General), 15, Bishopsgate, E.C.2, at 12 noon.

Jan. 28 (*Thurs.*).—**South Behar Railway Co. Ltd.** (Ordinary General), 25, Buckingham Palace Road, S.W.1, at noon.

Jan. 28 (*Thurs.*).—**Midland Railway Co., of Western Australia Ltd.,** (Ordinary General), Winchester House, Old Broad Street, E.C., at 12 noon.

XUM

Railway Share Market

The general trend in the stock and share markets this week was rather uncertain, and as the traffic figures of the main line railways were again disappointing, it is perhaps hardly surprising that the junior stocks have declined further on balance for the week. It is, however, reported that the lower prices are due largely to a falling off in demand and that there was, in fact, very little selling pressure. The disposition is to await next month's dividend announcements, and it is generally assumed that if they are up to market estimates there will probably be satisfactory response in prices.

L.M.S.R. ordinary attracted chief attention, but was subject to rather sharp fluctuations. Following disappointment with last week's moderate traffic gain of £14,000, the price reacted to 32⅛, but, as mentioned here before, it is often difficult to make a satisfactory comparison of traffic receipts at the beginning of the year with those of the corresponding period a year ago. The market is still anticipating that the dividend on L.M.S.R. ordinary will be 1 per cent. The 4 per cent. preference and 1923 preference were also reactionary in price, despite the apparently attractive yields offered. Great Western ordinary was relatively steady, although the traffic gain of only £3,000 for the past week was below expectations. It is, of course, confidently expected that the dividend will again be 3 per cent., and allowing for the sum in respect of over-paid rates, it is likely the results will show that in order to keep the dividend at this rate only a very moderate withdrawal from reserves will be necessary on this occasion. Southern deferred was reactionary and was influenced adversely by the small traffic increase of £2,000 for the past week. On the other hand, the preferred was bought on any decline, it being pointed out that the yield appears attractive and that there is little doubt the preferred dividend will be covered by a satisfactory margin of profits. L.N.E.R. stocks were out of favour, sentiment having been affected by the traffic decrease of £8,000 for the past week. London Transport "C" was again lower on balance.

Foreign railway stocks were dull. B.A. Great Southern issues were firmer on the good traffic return and Central Argentine stocks were steady for a similar reason. Cordoba Central debentures were lowered on the reported delay in submitting the purchase bill to the Argentine Congress. Leopoldina debentures were in moderate request. Canadian Pacific improved, and Beira Railway 5 per cent. debenture scrip was in request.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1936	Prices: Lowest 1936	Prices: Jan. 20, 1937	Yield % (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	834	17.1.37	17,180	— 930	3	33,710	41,210	— 7,500	Ord. Stk.	25	15¼	28	Nil
	Argentine North Eastern	753	16.1.37	8,387	+ 1,254	29	263,380	230,071	+ 33,309	,,	12	2	17½	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	54	45	65	6½
	Bolivar	174	Dec., 1936	5,600	+ 900	52	74,200	71,300	+ 2,900	6 p.c. Deb.	9	5	7½	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	16	11½	16½	3
	Buenos Ayres & Pacific	2,806	16.1.37	108,747	+ 18,618	29	$2,330,191	2,206,212	+ 123,979	Ord. Stk.	17½	6	16	Nil
	Buenos Ayres Central	190	2.1.37	$106,400	— $8,300	27	$3,869,500	$3,255,800	+ $613,700	Mt. Deb.	31½	11	39½	Nil
	Buenos Ayres Gt. Southern	5,084	16.1.37	202,419	+ 52,008	29	3,580,415	3,532,745	+ 47,670	Ord. Stk.	31¾	13¾	33	Nil
	Buenos Ayres Western	1,930	16.1.37	63,841	+ 12,900	29	1,292,634	1,216,836	+ 75,798	,,	29¾	11	28½	Nil
	Central Argentine	3,700	16.1.37	185,608	+ 44,333	29	4,129,559	3,441,990	+ 687,569	,,	32⅝₂	8¾	30½	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	21	4½	18½	Nil
	Cent. Uruguay of M. Video	273	9.1.37	12,715	+ 2,007	28	340,377	278,435	+ 61,942	Ord. Stk.	7¾	3	13	Nil
	Do. Eastern Extn.	311	9.1.37	2,431	+ 141	28	57,573	50,609	+ 6,964	—	—	—	—	—
	Do. Northern Extn.	185	9.1.37	1,335	— 139	28	39,461	36,529	+ 2,932	—	—	—	—	—
	Do. Western Extn.	211	9.1.37	921	+ 90	28	27,115	23,121	+ 3,994	—	—	—	—	—
	Cordoba Central	1,218	16.1.37	34,800	+ 7,890	29	942,980	858,530	+ 84,450	Ord. Inc.	5	1	5½	Nil
	Costa Rica	188	Nov., 1936	19,592	+ 6,242	22	91,581	68,699	+ 22,882	Stk.	36½	32	36	5⅝
	Dorada	70	Nov., 1936	14,800	+ 1,500	48	156,500	130,700	+ 25,800	1 Mt. Db.	107	101½	104½	5¾
	Entre Rios	810	16.1.37	16,911	+ 5,871	29	376,723	327,778	+ 48,945	Ord. Stk.	17	6	17½	Nil
	Great Western of Brazil	1,082	16.1.37	11,100	— 100	3	22,500	26,300	— 3,800	Ord. Sh.	½	5/16	3/4	Nil
	International of Cl. Amer.	794	Nov., 1936	$426,881	+ $11,920	48	$4,650,651	$4,258,842	+ $391,809	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	½	-/6	½	Nil
	La Guaira & Caracas	22½	Dec., 1936	6,225	+ 2,025	52	56,700	45,345	+ 11,355	Stk.	9	3	7½	Nil
	Leopoldina	1,918	16.1.37	22,747	+ 4,297	3	48,945	43,388	+ 5,557	Ord. Stk.	10½	3½	9	Nil
	Mexican	483	14.1.37	$326,400	+ $68,200	2	$553,300	$469,500	+ $83,800	,,	1¼	1/4	1½	Nil
	Midland of Uruguay	319	Dec., 1936	8,764	+ 814	26	49,941	39,314	+ 10,627	,,	1½	1/8	½	Nil
	Nitrate	397	15.1.37	6,781	— 3,170	2	6,781	9,951	— 3,170	Ord. Sh.	63/6	41/9	2¾	Nil
	Paraguay Central	274	9.1.37	$2,562,000	+ $388,000	28	$72,337,000	$62,956,000	+ $9,381,000	Pr. Li. Stk.	85	71	81½	7⅝
	Peruvian Corporation	1,059	Dec., 1936	81,512	+ 3,065	26	490,785	454,297	+ 36,488	Pref.	15	9	13	Nil
	Salvador	100	16.1.37	¢45,250	+ ¢9,500	29	¢462,758	¢447,446	+ ¢15,312	Pr. Li.Db.	18	16	15	Nil
	San Paulo	153½	10.1.37	27,010	+ 4,965	2	52,340	47,438	+ 4,902	Ord. Stk.	86	46½	89½	21⅝
	Taltal	164	Dec., 1936	4,090	+ 35	26	20,900	20,700	+ 200	Ord. Sh.	115/32	14/-	11¼	8
	United of Havana	1,353	16.1.37	19,785	+ 1,653	29	463,084	448,709	+ 14,375	Ord. Stk.	3¼	1	5	Nil
	Uruguay Northern	73	Dec., 1936	1,442	+ 327	26	6,481	4,830	+ 1,651	Deb. Stk.	5	3	8½	Nil
Canada.	Canadian National	23,564	14.1.37	649,824	+ 43,284	2	1,232,920	1,123,403	+ 109,517	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	76	51	76½	5⅛
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	104⅝	99⅝	101½	3 15/16
	Canadian Pacific	17,223	14.1.37	465,600	+ 58,200	2	914,200	810,300	+ 103,600	Ord. Stk.	16⅝	10 15/16	16	Nil
India.†	Assam Bengal	1,329	31.12.36	42,172	+ 6,761	39	977,938	934,223	+ 43,715	Ord. Stk.	87⅝	82¼	85½	3½
	Barsi Light	202	20.12.36	2,723	— 1,207	37	83,520	102,300	— 18,780	Ord. Sh.	77½	65½	66½	7½
	Bengal & North Western	2,107	20.12.36	76,301	+ 2,274	12	599,636	560,410	+ 39,226	Ord. Stk.	319	292⅝	310	5 15/16
	Bengal Dooars & Extension	161	31.12.36	4,032	+ 470	39	101,544	100,918	— 5,374	,,	127½	118	116½	6
	Bengal-Nagpur	3,268	31.12.36	137,825	— 60,827	39	4,440,713	4,778,472	— 337,759	,,	104	100¼	101½	3 15/16
	Bombay, Baroda & Cl. India	3,072	10.1.37	296,250	+ 31,950	40	6,553,575	6,246,750	+ 306,825	,,	114	110½	110½	3 7/16
	Madras& Southern Mahratta	3,229	31.12.36	222,075	+ 37,386	39	4,119,009	4,000,399	+ 118,610	,,	116½	108½	107½	7 1/16
	Rohilkund & Kumaon	572	20.12.36	13,995	+ 26	12	102,784	97,800	+ 4,984	,,	311	286	310	5 15/16
	South Indian	2,532	31.12.36	132,370	+ 19,201	39	3,018,147	2,962,213	+ 55,934	,,	107½	102 5/16	101½	5 7/16
Various	Beira-Umtali	204	Nov., 1936	68,789	+ 4,610	9	137,294	129,926	+ 7,368	—	—	—	—	—
	Bilbao River & Cantabrian	15	Dec., 1936	1,128	— 388	52	16,077	18,470	— 2,393	—	—	—	—	—
	Egyptian Delta	620	31.12.36	9,240	+ 845	39	190,677	189,824	+ 853	Prf. Sh.	21¼	15/8	15⅜	6 1/16
	Great Southern of Spain	104	29.8.36	568	— 2,514	35	33,629	62,623	— 28,994	Inc. Deb.	11½	1/8	3½	Nil
	Kenya & Uganda	1,625	Nov., 1936	190,145	+ 6,878	48	2,319,197	2,186,377	+ 132,820	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50½	37	47	7 7/16
	Mashonaland	913	Nov., 1936	120,282	+ 19,563	9	245,549	213,702	+ 31,847	1 Mg. Db.	105½	101 5/16	105½	4¾
	Midland of W. Australia	277	Nov., 1936	13,196	— 1,323	22	67,261	63,781	— 1,520	Inc. Deb.	97	93½	96	4⅛
	Nigerian	1,900	28.11.36	88,504	+ 33,570	34	1,339,381	1,055,269	+ 284,112	—	—	—	—	—
	Rhodesia	1,538	Nov., 1936	213,377	+ 25,550	9	443,341	390,521	+ 52,820	4 p.c. Db.	107	103½	105	3 15/16
	South Africa	13,263	26.12.36	608,880	+ 69,871	39	23,787,973	22,036,430	+ 1,751,543	—	—	—	—	—
	Victoria	4,728	Sept., 1936	790,314	+ 984	13	2,242,629	2,238,853	+ 3,776	—	—	—	—	—
	Zafra & Huelva	112	Oct., 1936	14,665	+ 1,978	44	80,613	114,122	— 33,509	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value.

Diesel Railway Traction

The Streamlined Train Outlook

WHATEVER may be the aerodynamic and power-saving advantages of the smooth and rounded contours which on diesel trains we conveniently dub "streamlining," there is little doubt that the speed and format of these trains has appealed to the travelling public in most civilised countries, and after much experimenting, we are now on the threshold of an extremely wide application of such trains. The German State Railway, always to the fore in this particular field, is building a variety of types for use on both "E" and "FFD" (fast and long-distance fast) trains, and with three and four cars. In France, the Nord is about to extend the scope of its ten triple-car non-articulated rakes, and in Holland more and more services are being undertaken by the 40 three-car trains, some of which are now working in rakes of two and three triple-car sets. But it is in America that the greatest developments are taking place. To those who held that diesel trains could not give the necessary dining and sleeping accommodation, the 11-car and 12-car trains of 1936 might have been deemed an adequate reply, but it is being driven home by the 17-car sets, 1,250 ft. long, now being built. To borrow a remark applied by a well-known engineer to the Garratt locomotive, "the length is limited only by the length between stations."

The Small Diesel Locomotive

FOR every diesel-mechanical shunting locomotive of 150 b.h.p. or more built in this country there are a dozen of 20 to 80 b.h.p. which receive little notice, although in their sphere—and it is a large one—they are most useful. Built mainly for use in plantations, quarries, and industrial works, they are nevertheless by no means unknown in standard-gauge railway service (the German State Railway has hundreds of them of 20 to 70 b.h.p.), where frequently they are classified as loco-tractors. The hauling capacity on the lowest gear step varies from about 80 tons with a 20 b.h.p. model to over 300 tons with a 80 b.h.p. type, but in the very first issue of this Supplement we described a 12-ton loco-tractor fitted with a Vulcan-Sinclair fluid coupling and an ordinary two-speed gearbox, which, as shown in the third issue (*i.e.*, March 24, 1933), could haul a load of 650 tons, although it must be admitted that this load was made up of comparatively few vehicles of large size. The success of loco-tractors is due mainly to two reasons: first, the better performance—at least 20 per cent.—which can be got from a diesel locomotive compared with a steam locomotive of equivalent weight, due to the more even torque and the consequently lower factor of adhesion which can be permitted safely; and secondly, because on such small ranges a steam locomotive, through the principles of its construction, must inevitably be overpowered and more than usually wasteful for any given maximum tractive effort. For instance, on certain well-known diesel loco-tractors of 22 b.h.p. the tractive effort is 1,650 lb. up to 4 m.p.h., in which range it can haul 90 to 95 tons. A steam locomotive of similar capacity could hardly be built for the standard gauge unless it was overpowered, for the required weight of the diesel is only 6 tons and of a steam engine about the same. Moreover, the steam locomotive is suitable for higher speeds and although this may be useful for general purposes, it is not necessary for yard or siding work, and this property of general usefulness tends to prevent the production of the most efficient design for low-speed work. And it is not nearly so difficult to find yard duties in which a speed of 10 m.p.h. will never be exceeded as is sometimes made out by advocates of steam shunting. As with larger locomotives, reliability and simplicity are important factors, but there is more opportunity of obtaining these desiderata in small sizes, where there is little incentive to fit refinements; but, as always, experience in this class of work brings the best machine. Finally, owing to the very close approximation to the correct size which is possible with the diesel, the net and gross operating costs may be reduced to the optimum figures.

Zeppelin Engines for Rail Traction

THE German State Railway is proposing to instal in some new streamlined oil-electric trains Mercedes-Benz engines of the same general type as used in the Zeppelin *Hindenburg* (LZ 129). Such an installation should prove the first direct application of aircraft oil engines to railway duties, for the earlier Beardmore engines and the Maybach 410 b.h.p. design, although developed from aviation experience, were at least three times the weight of the aviation engines then existing and over four times the present weight. It is a pointer to the improved reliability of high-speed light-weight engines in general that it should even be thought feasible to experiment with a design weighing less than 4 lb. per b.h.p. on the continuous rating. Two sizes of Mercedes-Benz aircraft engines are in production. The larger, a 16-cylinder vee engine with a continuous rating of 1,100 b.h.p. at 1,500 r.p.m., is that actually installed in the *Hindenburg*. The smaller model has been developed more particularly for aeroplanes, and is a 12-cylinder vee type with a continuous output of 720 b.h.p. at 1,720 r.p.m. *Hindenburg's* engines have a two-piece silumin crankcase carrying steel cylinder blocks; the cylinder heads, also of steel, incorporate the usual Benz pre-combustion chamber and carry two inlet and two exhaust valves per cylinder. Bosch fuel pumps are used. On the continuous rating the fuel consumption is 0·4 lb. per b.h.p.hr., and the weight 4,325 lb., or 3·93 lb. per b.h.p. Comparing the weight characteristics with the present German three-car trains powered by two supercharged Maybach 600 b.h.p. engines, weighing a little over 9 lb. per b.h.p., the saving is 3 tons on the engines and probably about 2 tons on electrical equipment, so that allowing for 100 b.h.p. lower output, the power-weight ratios would remain approximately the same.

Railcar Development on the German State Railway

*By REICHSBAHNDIREKTOR STROEBE**

FOR a number of years various important railway administrations in Europe have improved their services by the introduction of railcars. The German State Railway has devoted particular attention to this development, as may be judged from the fact that the number of diesel railcars and trains in service has increased from 103 in 1933 to 340 at the present date. The technical advance in the design of the railcars themselves is shown by the increase of the average mileage per unit in the last year by 20 per cent., and by the increase of average power per unit by 95 per cent. in the last three years.†

Branch-Line Cars

In the accompanying table is given a classification of the diesel railcars and trains now in service on the German State Railway. For branch line service the simple two-axle railcar has proved satisfactory. Owing to the frequency of unprotected level crossings on the branch lines in Germany a maximum speed of 44 m.p.h. is sufficient. Besides having a luggage compartment all these railcars have to be capable of hauling goods vehicles when required. These cars have 41 third class seats and two driving compartments; power is provided by a 150 b.h.p. M.A.N. diesel engine suspended beneath the floor of the car in a special engine frame. Mechanical drive of the Mylius type is employed, and the latest examples of these cars, in which welding is extensively used in construction, weigh in service condition 17·4 tons. These cars run some 94,000 miles between each engine overhaul. Examination takes place every 19,000 miles, particular attention being paid to the bearings. The average daily mileage is 190. The mechanical transmission has proved thoroughly reliable for this range of performance, the saving as compared with the displaced steam-operated services is as much as 25 per cent., and maintenance costs have steadily decreased during successive years. To provide for abnormal passenger traffic two-axle trailer cars containing 47 third class seats have been provided. With fully-loaded trailer attached these cars can climb a gradient of 1 in 40 at a speed of about 19 m.p.h.; without the trailer the corresponding velocity is 27 m.p.h.

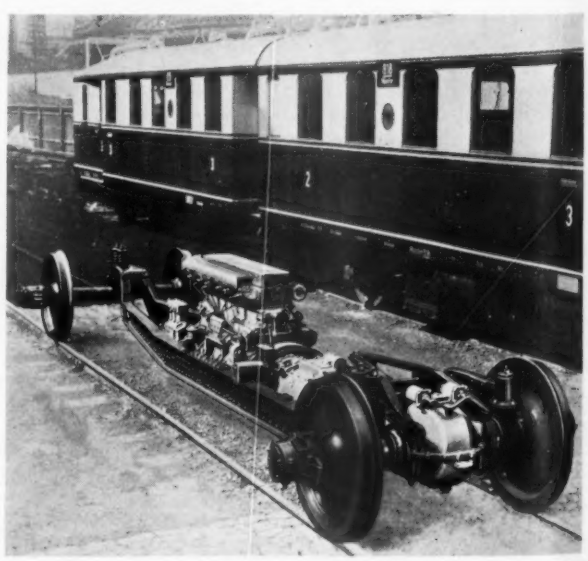
The wish of the traffic authorities to be able to run branch-line railcars on the main line also, led to the introduction of larger four-axle branch line railcars with diesel-mechanical drive. These cars have 210 b.h.p. engines, mainly of the Maybach and M.A.N. types, and weigh 31 tons. Engine and transmission are built into one bogie. These cars have 67 seats as well as a luggage compartment and two drivers' compartments. The highest speed is 50 m.p.h. They have proved so satisfactory that the type will be continued, with, however, hydraulic instead of mechanical drive; further, the corresponding trailer cars will in future be provided with means of control.

For more onerous branch line service a new type of four-axle railcar is at present in course of delivery, together with corresponding trailer cars. These cars differ in one important respect from those hitherto in use. For the first time a slow-running M.A.N. engine of 360 h.p. has been selected, in order to ascertain the suitability of this type of engine for four-axle railcars. The engine has the relatively considerable weight of 19·5 lb. per b.h.p., but can nevertheless be built into the bogie. To reduce the total weight as much as possible, hydraulic transmission is employed. The cars have multiple-unit control so that several units can be coupled together as a train. Particular attention has been paid to the light construction of the body framework, so that in spite of the heavy engine the weight in working order of the railcar is only 37 tons, and of the trailer 19·6 tons.

The necessity, especially in branch line traffic, of making as large a proportion of space as possible available for passengers and luggage, led to the arrangement of the engine and drive entirely underneath the floor of the vehicle for the latest standard types of railcar. Further, the division of the engine into two separate units has been adopted as standard practice, so as to minimise the

TYPES OF GERMAN DIESEL RAILCARS AND TRAINS

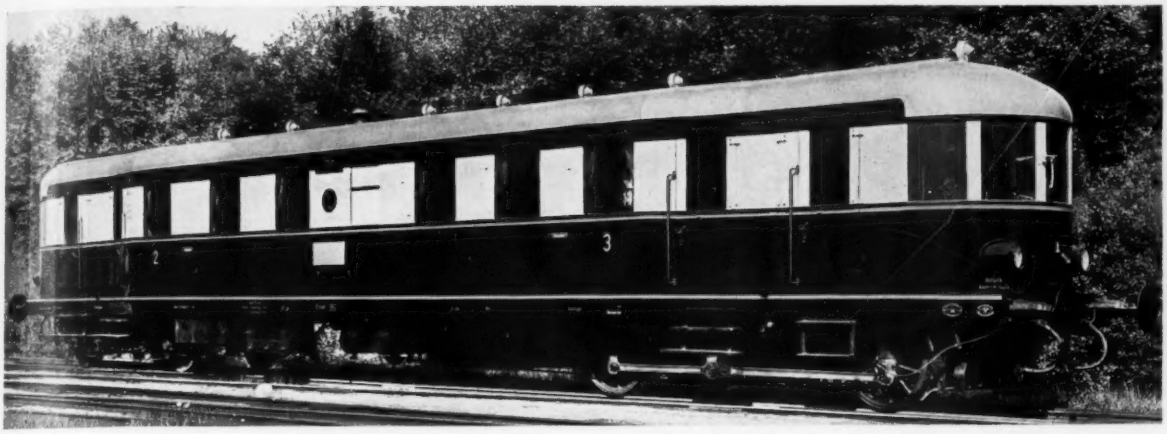
Service	Type	Performance	Normal Maximum Speed
Branch line only ..	2-axle car	150 b.h.p., with trailer	44 m.p.h.
Main and branch line ..	4-axle car	200—600 b.h.p., with driving trailer	50–69 m.p.h.
	8-axle double car ..	2 × 275 b.h.p. (horizontal engines) with driving trailer	56 m.p.h.
Main line	6-axle twin Ruhr train	2 × 400 b.h.p. ..	75 m.p.h.
	8-axle triple Ruhr train	2 × 400 b.h.p. ..	75 m.p.h.
	12-axle triple train ..	2 × 450 b.h.p. ..	75 m.p.h.
High-speed services ..	6-axle double fast train	2 × 400 b.h.p. ..	100 m.p.h.
	8-axle triple fast train	2 × 600 b.h.p. ..	100 m.p.h.
	12-axle triple fast train	2 × 600 b.h.p. ..	100 m.p.h.
	16-axle quadruple fast train	1,350 b.h.p. ..	100 m.p.h.



150 b.h.p. M.A.N.-engined cars showing arrangement of engine and Mylius transmission

* In an address to the Engineers' German Circle at the Institution of Mechanical Engineers, December 14, 1936.

† In the issue of this Supplement for January 24, 1936, was published a detailed account of diesel traction on the Reichsbahn.



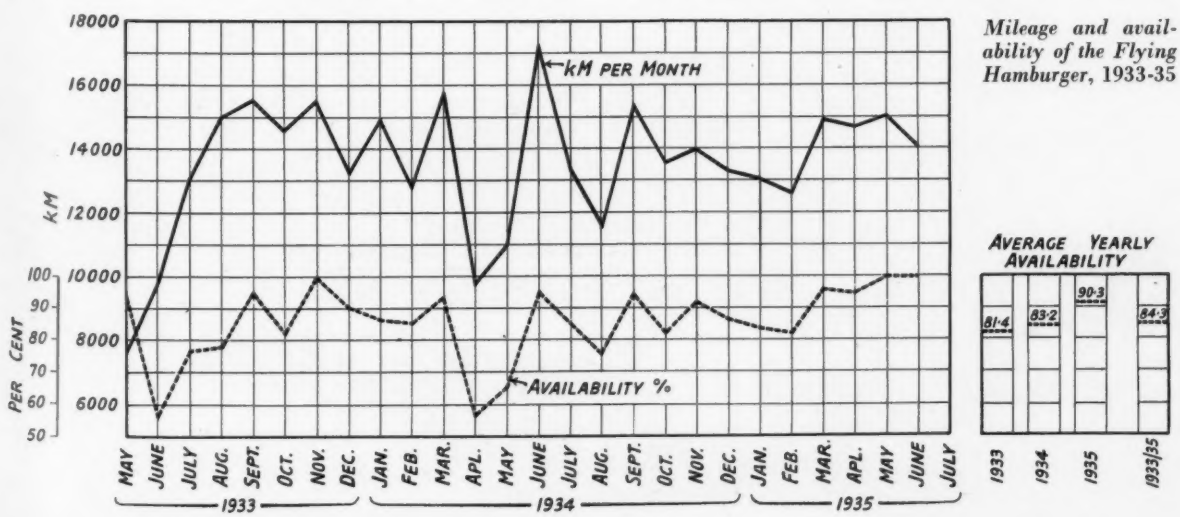
Standard 210 b.h.p. Maybach diesel-mechanical car, German State Railway

possibility of complete failure. Both of these considerations determined the adoption of fast-running horizontal oil engines. To begin with, a 180 b.h.p. horizontal engine was developed by the Deutsche-Werke-Kiel and tried experimentally under a two-axle railcar. The result was very favourable; this engine has already run 50,000 miles without any modification being necessary. On the basis of the experience gained a larger 275 b.h.p. horizontal engine was designed by close co-operation between the German State Railway and the industry, and this engine is now being produced by Deutz, M.A.N., Deutsche Werke, and Daimler-Benz. The essential features and connections are standard, so that the engines from the various firms are interchangeable, although they differ in detail. These engines are being fitted in the double cars figuring as the third item in the table, which contain 18 second class and 110 third-class seats. A trailer, also fitted with driving compartment, may be added. Hydraulic transmission is adopted and the arrangement is such that an engine is suspended beneath each body frame and drives, through the medium of a cardan shaft, the hydraulic converter built into one bogie frame. The first normal railcars of this type will be taken into service in 1937, but already a tourist observation car with a sunshine roof and powered by two of the D.W.K. engines is at work.

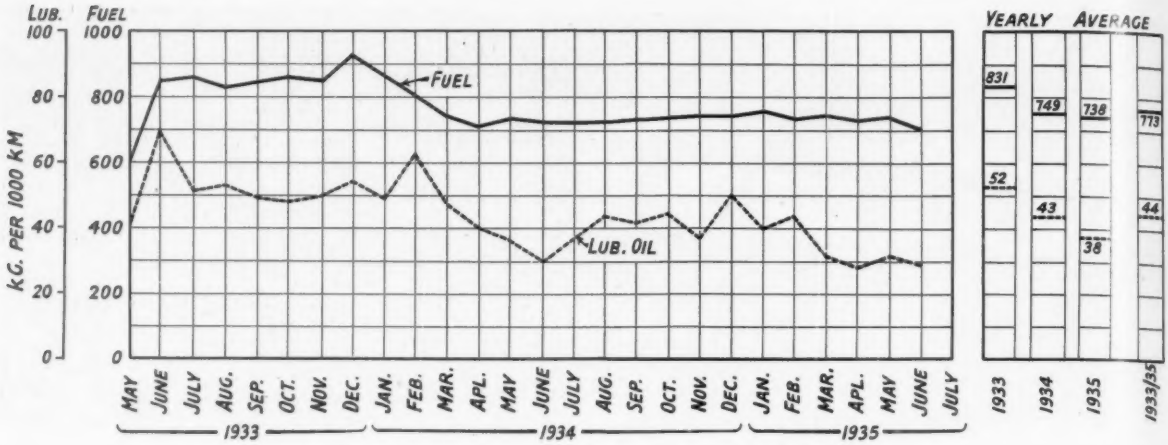
For main-line service a large number of four-axle railcars of the type shown as item 2 in the table are in use, but with engines of larger size giving the upper limits of power and speed mentioned in the table, namely 400-600 b.h.p. and 63-69 m.p.h. respectively. The engines are built into the bogies and electrical transmission is used. After a number of initial difficulties were overcome the engines have proved thoroughly reliable in service. Whereas two years ago mileages of 12,500 between overhauls could be attained only with difficulty, mileages of 37,000 to 50,000 are now the rule with the Maybach engines, and in a number of cases as much as 62,000 miles have been run without difficulty. The electrical transmission has in the main proved reliable, even though it suffers from the disadvantages of relatively high weight and a multiplicity of parts. Such failures as have occurred have been mostly due to the control and auxiliary apparatus, which do not yet seem to have developed quite to the point of reliability in the onerous conditions of railway service.

The traffic in the industrial area of the Ruhr makes rather special demands, and two articulated types of unit are being developed for this service, both equipped with diesel-electric drive. In the triple unit a new arrangement of the seating accommodation, with lengthwise seats at one side of the carriage and cross-seats opposite, is being tried experimentally.

For the E-train (*Eilzug*) traffic over greater distances a



Mileage and availability of the Flying Hamburger, 1933-35

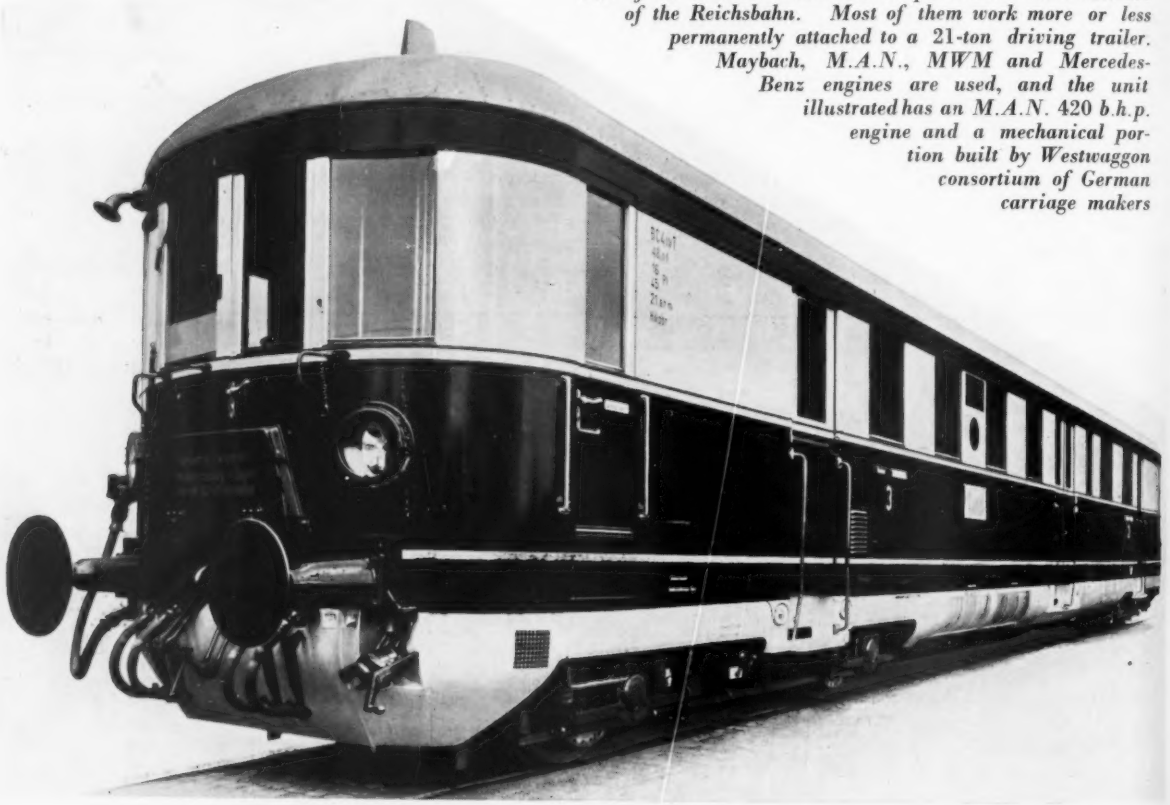


Fuel and lubricating oil consumption of the Flying Hamburger

triple main-line unit is being developed from the triple-car Ruhr trains, also with diesel-electric drive. For this unit it is intended to use Daimler engines of the type used in the airship *Hindenburg*. In this case the carriages are not articulated, in order to ensure the greatest possible flexibility in train make-up. The middle carriage is close-coupled to the two end carriages, and the extreme ends of the latter are provided with Scharfenberg automatic couplers. In addition to luggage and postal compartments the triple unit has seating accommodation for 30 second class and 15 third class passengers.

A special type, for use both on main and branch lines, is the double-bogie observation car, which first went into service last summer. The construction of such a car became possible only when the entire machinery installation could be arranged underneath the floor of the car. This car also embodies for the first time a roll-top roof. The observation car is equipped with two horizontal 180 b.h.p. D.W.K. engines and hydraulic transmission. The engines are insulated from the body of the car by rubber springs to prevent vibration, and the hydraulic drive is built into the bogie frames. The highest speed is 75 m.p.h., so that a distant scenic route can be quickly reached. This car has aroused great interest [see issue of this Supplement for October 30, 1936—ED.], and has been very successful, and further cars of the same type

One of the numerous 410-420 b.h.p. diesel-electric railcars of the Reichsbahn. Most of them work more or less permanently attached to a 21-ton driving trailer. Maybach, M.A.N., MWM and Mercedes-Benz engines are used, and the unit illustrated has an M.A.N. 420 b.h.p. engine and a mechanical portion built by Westwaggon consortium of German carriage makers



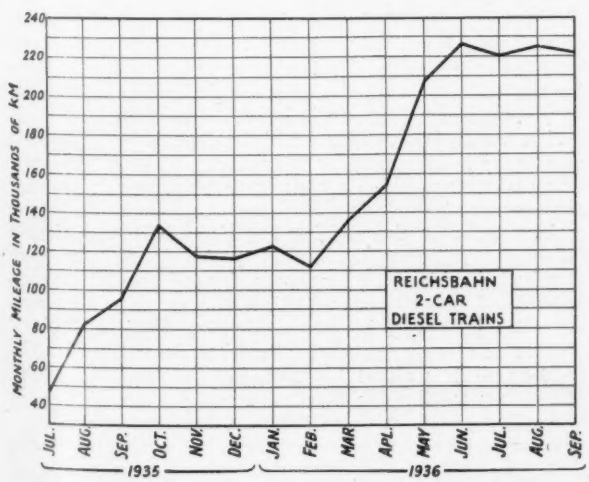
will be built immediately with the new types of horizontal engines. [One of these new types is described briefly elsewhere in this issue.—ED.]

Super-Speed Vehicles

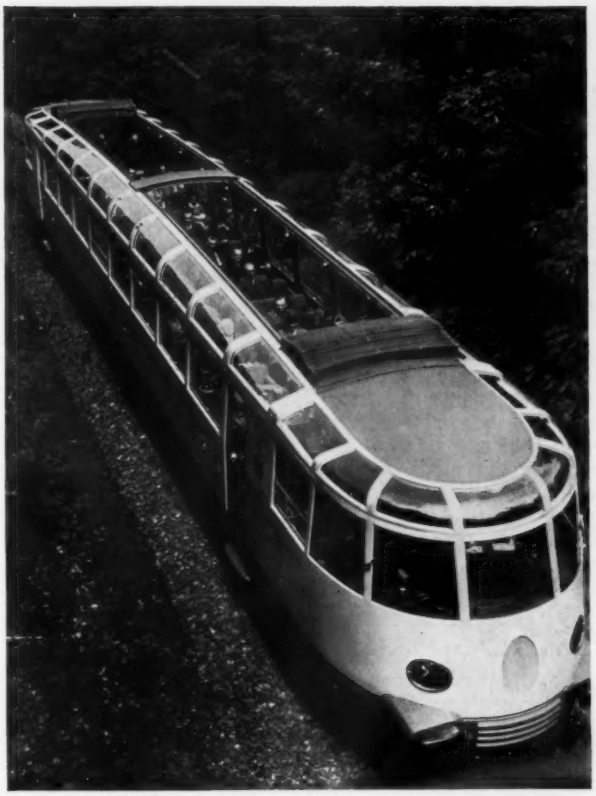
The high-speed diesel trains (*Schnelltriebwagen*) differ essentially from those so far considered in that the greatest possible comfort must be afforded to the traveller, in view of the long distances covered. The first high-speed train has now completed more than three years' regular service between Berlin and Hamburg, covering an average daily mileage, excluding Sundays and holidays, of 335 miles. Fig. 1 shows the performance of the car diagrammatically, and Fig. 2 the consumption of fuel and lubricating oil over the same period. The success which has attended the gaining of experience with the Maybach engines is clearly shown in these diagrams. Even in this high-speed service the engines run 50,000-63,000 miles without interruption, and the maintenance costs have steadily decreased. The popularity of the train, moreover, has been such that all the expenses connected with it have been more than covered. The Flying Hamburger has now completed over a quarter of a million miles, and during this period the complete vehicle has only once had a general overhaul.

In 1934 a further 13 cars were ordered which conform in general to the design of the original Flying Hamburger, though embodying a number of improvements in detail. The modifications include the provision of Scharfenberg automatic couplers and multiple-unit control (so that several units may be coupled together as is required by some of the new services operated by these trains), and a considerable increase in weight. An interesting instance of multiple-unit is found on the Berlin—Munich—Stuttgart service where a 7½-mile grade at 1 in 40 in the Thuringian Forest has to be surmounted. The decision to couple together the two sets destined for Munich and Stuttgart respectively, as far as Nuremberg, arose mainly in order to increase the margin of power, both in ascending and whilst braking during the descent, on this grade.

Four experimental triple-car high-speed trains containing third class as well as second class accommodation have also been built. In order to provide a comparison under strictly similar conditions, two of these trains were equipped with electrical transmission driving in the middle articulated bogies, and two have hydraulic transmission driving the end bogies; 600 b.h.p. supercharged Maybach



Mileage of the two-car streamlined trains of the German State Railway



360 b.h.p. sunshine-saloon railcar with two horizontal D.W.K. engines

engines are employed.* The service weight of the diesel-electric units is about 9 per cent. higher than that of the hydraulic unit. (129 as against 119 tons.) Experimental runs last February showed that speeds of over 125 m.p.h. can be attained with such units, and the perfectly smooth running of the trains at these speeds was especially noteworthy. As these trains have been in regular service for only three months it is too soon to give particulars of the service results, but up to the present both the supercharged engines and the hydraulic transmission have proved thoroughly satisfactory.

In future third class accommodation will not be provided in the high-speed diesel trains, but further triple-car diesel-electric rakes with 120 second class seats are in course of development. These will be provided with compartments and side corridors, and will have separate bogies for each carriage.

Finally, there remains to be added to the group of high-speed trains a four-car diesel-electric set, at present in course of construction. This type represents a considerable departure from previous practice since the motive power is concentrated in one slow-running eight-cylinder M.A.N. engine developing 1,300 b.h.p. with supercharger in operation. This engine, together with an auxiliary engine of 150 b.h.p. is mounted in a special carriage containing also luggage and postal accommodation. The driving motors are divided among the bogies of the four carriages. This train will also be distinguished from its predecessors by having in addition to 130 second class seats, a restaurant car with 25 seats. Büchi supercharging apparatus is to be incorporated.

* These cars and their transmission systems were described in detail in the Diesel Supplement for January 24, 1936.

American Streamlined Train and Locomotive News

THERE has been considerable activity recently in the field of super-speed trains and locomotives in the U.S.A., and orders valued at $5,350,000 have been placed within the last eight weeks. What will be by far the largest diesel trains in the world were ordered in December conjointly by the Union Pacific, Southern Pacific, and Chicago & North Western Railroads, to operate between Chicago and California and supersede the existing 11-car *City of Los Angeles* and *City of San Francisco* trains of the U.P.R.R. (see July 10, 1936, issue of this Supplement) which will be transferred to services where the required accommodation is within their capacity. The two new trains will be made up of 17 cars (3 power, 1 auxiliary and 13 revenue); each power car will house two 900 b.h.p. 12-cylinder Winton engines, giving an aggregate output of 5,400 b.h.p., and a fourth car will contain the auxiliary diesel sets, air conditioning and lighting equipment. Multiple control centred in the leading power vehicle will enable the engines in any of the power cars (and their associated traction motors) to be cut in or out at will.

The trains will be about 1,250 ft. long, and the capacities will be 174 Pullman and 54 coach passengers for the *City of San Francisco* and 150 Pullman and 104 coach passengers in the *City of Los Angeles*. Each train will have two dining cars, and the Pullman cars have new developments in sleeping car equipment. The mechanical portions will be built by the Pullman-Standard Car Manufacturing Company. The cost of the two trains will be approximately $3,000,000 (£615,000), and according to a statement issued by the presidents of the three railroads concerned: *The tremendous popularity of the present streamliners and the inability of the railroads to take care of desired reservations, even weeks in advance, is the primary reason for building the new trains.*

A recent convert to diesel traction is the Chicago, Rock Island & Pacific Railroad, which has ordered six 1,200 b.h.p. streamlined oil-electric locomotives from the Electro-Motive Corporation for fast interurban services. They will be powered by Winton two-stroke engines and will be used to haul light-weight stainless steel trains now being built by the E.G. Budd Manufacturing Company. Four of these trains will have three cars and two will have four cars (seating capacities from 140 to 210), so that the power-weight ratio should be ample to maintain very fast schedules over an undulating profile. The Gulf, Mobile & Northern Railroad, whose 800 b.h.p. Rebel trains have been in service since the summer of 1935, has ordered two more trains. Two twin-unit Winton-engined locomotives, generally similar to the Atchison, Topeka & Santa Fe Railroad giant (issue of this Supplement for October 4, 1935) have been ordered by the Baltimore & Ohio Railroad, and will probably be employed on the Washington-Chicago route. Four 900 b.h.p. two-stroke engines will give an aggregate of 3,600 b.h.p. per locomotive, this great power being a commentary on the experience of the B. & O. with its earlier 1,800 b.h.p. locomotive (issue of this Supplement for July 10, 1936) which was found insufficiently powerful to pull the Royal Blue train and was therefore transferred to the Abraham Lincoln express of the associated Chicago & Alton Railroad. In the shunting field the Aluminium Company of America has ordered a 600 b.h.p. oil-electric locomotive from Alco.

At the end of 1936, the New York, New Haven & Hartford Railroad took delivery of ten heavy shunting locomotives, five with 660 b.h.p. Cooper-Bessemer engines and five with 600 b.h.p. Ingersoll-Rand power units. The main contractor was the American General Electric Company. The average weight of the two designs is 89 long tons, the maximum tractive effort about 60,000 lb. and the continuous tractive effort rating 26,000 lb. at 6.35 m.p.h. Trucks, underframe, and superstructure all are built up by welding.

On December 18, the Chicago, Burlington & Quincy Railroad began operation of the two new 1,800 b.h.p. seven-car Twin Zephyr trains between Chicago and the Twin Cities, the schedule remaining as before at 66 m.p.h. for the 431 miles to and from Minneapolis. One of the older three-car Zephyrs previously on the service had already been transferred further south, and the second one has now followed.

Letter to the Editor

(The Editor is not responsible for the opinions of correspondents)

Electro-Magnetic Track Brakes

Berlin 0.112.
December 17, 1936

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—In the *Diesel Railway Traction Supplement* for June 12, 1936, p. 1155, Mr. L. K. Sillcox (in a paper read before the Engineering Institute of Canada) expresses a very unfavourable opinion of electro-magnetic track brakes, basing his remarks on certain assumptions regarding the performance and watt consumption of the braking magnets.

These assumptions are purely theoretical, the magnets actually having a much higher performance and lower consumption than Mr. Sillcox states. Also, the objections that the contact with the rail affects the performance, that sanding cannot be employed, that the shoes must be subject to enormous wear, that there is not enough space between the wheels for the accommodation of the magnets, and that the weight and cost are prohibitive, all of these are purely theoretical, and long contradicted by practice.

For example, the magnets made by us develop almost exactly twice the contact pressure assumed by Mr. Sillcox. This alone doubles the braking force. In addition, the friction actually operative is at least 25 per cent. higher than assumed. One can therefore rely on obtaining 2½ times the braking force mentioned by Mr. Sillcox, and there is no difficulty in obtaining this with half the watt consumption which he assumes.

Again, there is no point in calculating by how much the braking effort of the compressed air brake at the limit of adhesion exceeds that of the magnetic brake, because no one would seriously propose to replace the air brake by the track brake. If, however, the retardation must for any reason be raised above the limit of adhesion, the only means of doing this is by the electromagnetic track brake, which is the only brake independent of the limit of adhesion. These higher retardations are of vital importance where such high speeds as those of modern railcars are concerned.

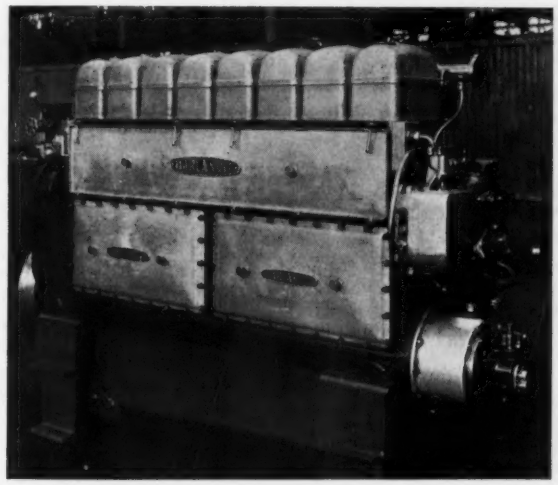
As regards the size and loading of the battery, it should be emphasised that the battery which is, in any case, required in high-speed railcars for other purposes, is capable of operating the track brake magnets, the consumption of which is very moderate. With a 100-volt battery the consumption for braking from 160 km.p.h. (100 m.p.h.) is about 2½ amp. hr. for the train equipment assumed by Mr Sillcox.

KNORR BREMSE A.G.

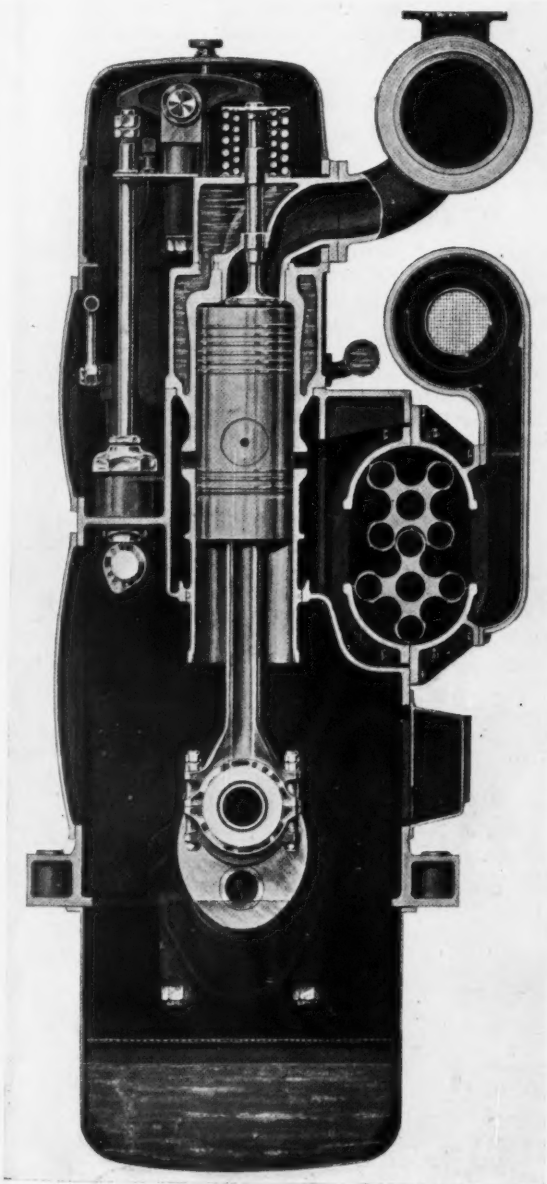
JUGOSLAV DIESELS.—The Jugoslav State Railways has received tenders for 7 railcar trains for the 760 mm. gauge lines; each unit consists of two bogie railcars with a bogie trailer between.

BRITISH ENGINES FOR AUSTRALIA

THE ten 360 b.h.p. two-stroke oil engines ordered by the New South Wales Government Railways from Harland & Wolff Limited have been shipped from Belfast and some of them have arrived in Australia. They are to be installed in twos in four trains having a top speed of 75 m.p.h. and two sets will be held as spares. Voith-Sinclair hydraulic transmission has been supplied by the Hydraulic Coupling & Engineering Co. Ltd. to go with these engines. The trains will be composed of one double-engined power car and three trailers, and the passenger saloons will be air-conditioned. It is proposed to run these trains on the up-country lines between Parkes and Broken Hill and from Dubbo to Bourke, and an extra baggage car will be attached when necessary.



360 b.h.p. eight-cylinder Harland-B. & W. engine as supplied to New South Wales



Cross section of 360 b.h.p. Harland-B. & W. two-stroke engine for rail traction

Of the Harland-B. & W. type, the engines have eight cylinders 135 mm. by 220 mm. (5·33 in. by 8·7 in.) and have a continuous rating of 330 b.h.p. at 1,200 r.p.m.; the short-time output is 360 b.h.p. On the continuous rating the piston speed is 1,735 ft. per min. and the brake m.e.p. 70 lb. per sq. in.; the weight is about 15 lb. per b.h.p., and this weight has been attained by the characteristics of the two-stroke principle and without resort to extensive use of aluminium alloys or injudicious paring of the scantlings. The engine is totally-enclosed.

Scavenging System

Scavenging air is admitted through ports in the cylinder wall and, sweeping upwards, expels the burnt gases through a cam-operated valve in the cylinder head. The rocker shaft above the valve is carried on ball bearings. The scavenging ports extend right round the wall and thereby assist in maintaining a uniform temperature gradient and a reduction in the heat stresses. The fresh air charge is provided by a positive rotary blower comprised of two rotors each with four vanes working in a machined casing. The rotors intermesh without actually touching, and both are driven by external gearing.

Welded steel construction has been adopted for the crankcase, which at the bottom is secured directly to the railcar frame members and at the top carries the cylinders and heads, which constituents are cast of iron in one piece and are dropped into the crankcase. Through bolts from the main bearing straps to the cylinder heads take the load. A light welded steel sump is attached to the bottom of the crankcase. The crankshaft is forged in one piece and is carried on seven bearings with white-metal linings run on steel shells. Both shaft and pins are hollow bored. The connecting rods are of alloy steel, and have white-metalled big ends and bronze-bushed small ends carrying fully-floating gudgeon pins attached to cast iron pistons. Separate Harland-B. & W. fuel injection pumps are fitted to each cylinder, and force the fuel through two nozzles located at opposite sides of the combustion chamber.

SMALL STANDARD-GAUGE SHUNTERS

DIESEL loco-tractors for light-duty yard service have many advantages, principal among which is their capacity for continuous work, so that the "light" referred to above need not apply to the amount but rather to the loads to be hauled. Simplicity is an essential, for the great majority of potential users are attracted first by cheap first cost and secondly by fool-proof and trouble-free operation. To meet these requirements on the standard gauge the Hunslet Engine Co. Ltd. has evolved a series of tractors developed largely from the numerous narrow-gauge machines exported to many parts of the world, and a variety of sizes with a variety of engine makes is available.

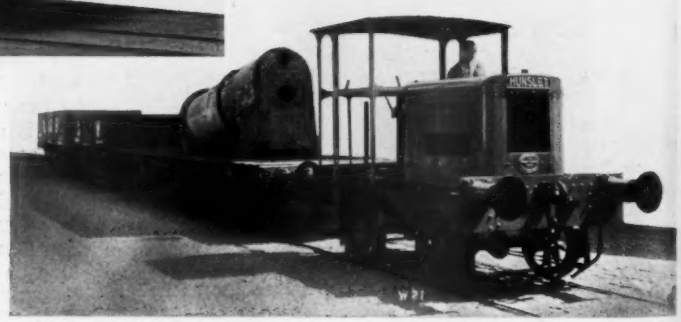
Two sizes, 20 and 40 b.h.p., are illustrated on this page. The smaller unit is powered by a Lister oil engine running at 1,200 r.p.m. and developing a maximum output of 22 b.h.p. The 2 ft. 9 in. wheels are spread over a base of 5 ft. 6 in. and the tractor will negotiate with ease a curve of 60 ft. radius; the overall length is 10 ft. 7 in. and the width 7 ft. The height of the locomotive illustrated, viz., 9 ft. 8 in., can easily be cut down if desired for any special conditions. Although in any case there is not much incentive to fit refinements in such a size, every opportunity has been taken to make the mechanical details as straightforward as possible, and further simplification without loss in operating efficiency has been obtained by limiting the number of steps in the gearbox to two, corresponding to maximum track speeds of 4 and 8 m.p.h. The corresponding maximum tractive efforts are 1,640 and 820 lb., so that assuming a starting resistance of 20 lb. per ton and a running resistance of 14 lb. to cover the usual inferior track and wagon conditions found in small yards, this size of tractor can start and haul on the level a trailing load of about 75 tons in first gear and haul about 53 tons in second gear. If a greater speed is required a three or four-speed gearbox can be fitted, but of course the same load cannot be hauled up to the top speed.

The larger type of tractor illustrated is powered by such oil engines as the McLaren or Fowler-Sanders, a 40 b.h.p. engine of the latter make being fitted to the War Department tractor shown. This Fowler-Sanders engine is one of the first totally-enclosed oil engines used in this class of work; the C.A.V.-Bosch fuel pumps are located beneath the lower inspection covers and the injectors beneath the small upper covers; the air filter lifts off *en bloc* with the lower inspection door. The water circulating system is thermostatically controlled and as a general practice the radiators are of the sectional type.

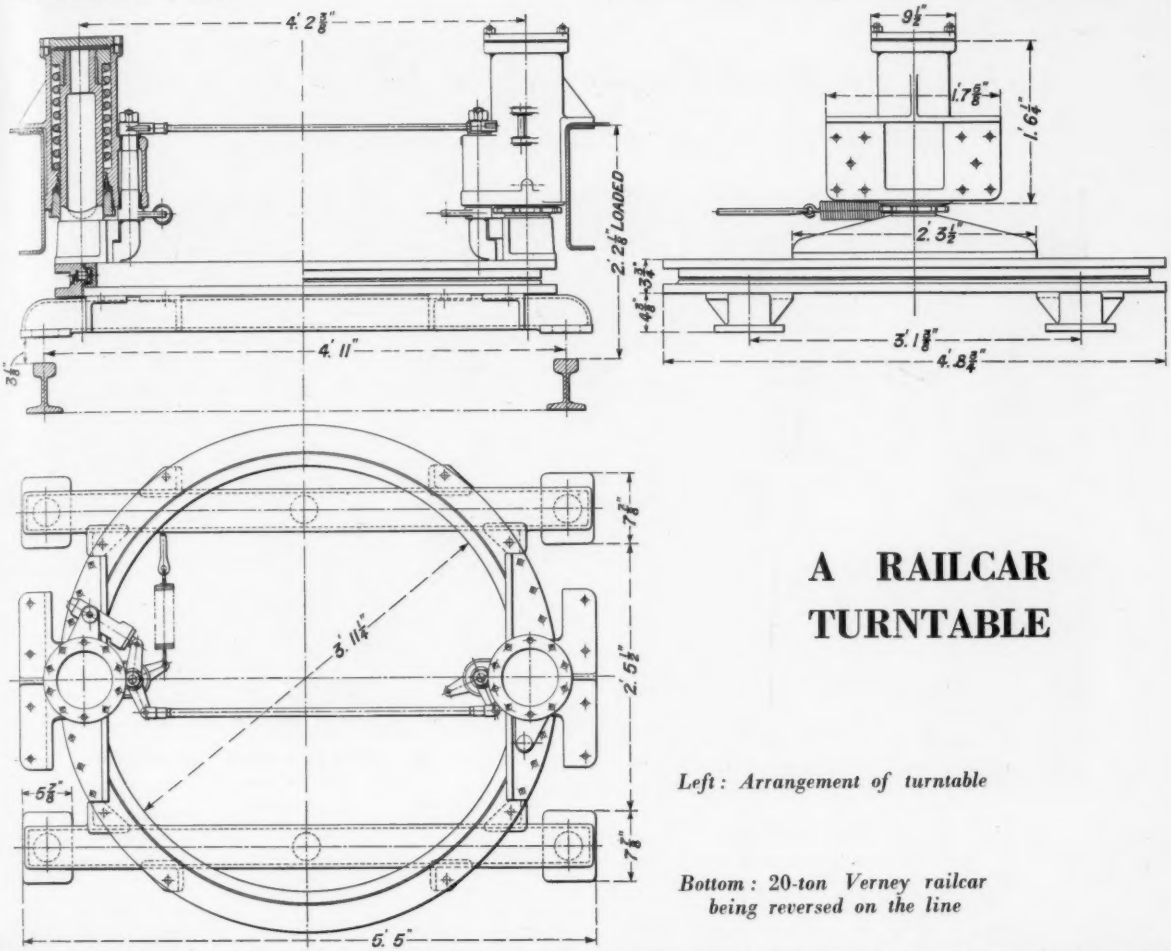
A two-speed gearbox giving track speeds of 3½ and 7 m.p.h. is incorporated in the W.D. tractor, but three-speed boxes of the same type are fitted to other tractors operating in quarry and industrial service. The hauling capacity on the bottom gear step is approximately 200 tons. Normally, hand starting of the engine is provided, but the W.D. locomotive has electric starting, and certain others have a small petrol engine for turning the barring gear. The electric starting gear is of an exceedingly simple pattern which does away with the necessity of a battery and operates directly from the dynamo. As with the smaller tractors standard buffing and drawgear is fitted, and the mechanical portion is of robust construction. The final drive of the 40 b.h.p. machines is through a geared jackshaft and rods thence to the wheels.

Above: 40 b.h.p. tractor for the War Department

Top right: 40 b.h.p. Fowler Sanders oil engine installed in loco-tractor



Right: 6¾-ton 20 b.h.p. tractor engaged in typical yard service



A RAILCAR TURNTABLE

Left: Arrangement of turntable

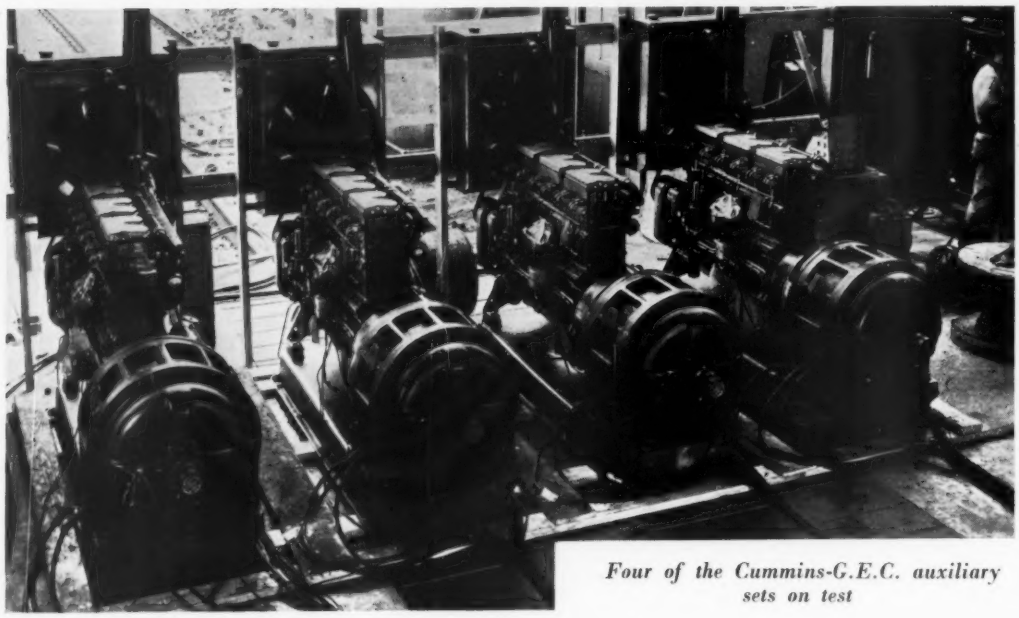
Bottom: 20-ton Verney railcar being reversed on the line

DESCRIBING one of the light railcars of the French Eastern Railway in our issue of November 27, 1936, we made special reference to a turntable which the railcar carried along with it. By the courtesy of the car builder, the Soc. Central de Chemins de fer et d'Entreprises, we are now able to illustrate this interesting innovation.

The apparatus includes two hydraulic jacks; a circular roller track; an oil pump; and a three-way pneumatic valve. The equipment is interlocked so that operation cannot begin until the car is at rest. Moving the valve into the first position brings the oil-pump into circuit with the jacks; in the second position the oil under pressure is admitted to an auxiliary cylinder which unlocks the rams of the jacks, and the oil, which becomes heated in the course of being forced through the evacuating hole, raises the rams and thus the railcar. In the third position the jack cylinder is brought into communication with the suction side of the pump, and oil under pressure is always beneath the rams, thus permitting of easy unlocking. The turning operation is done by hand, the locking apparatus ensuring that the car cannot slip. To lower the vehicle the valve is turned backwards. In the second position the unlocking apparatus comes into operation and in the first position the weight of the car forces the oil slowly from the cylinder, after which the apparatus is locked by the action of helical springs. A manometer fitted in the pressure circuit provides for the gradual deceleration of the descent, eliminating shock on the arrival at the bottom position.

Auxiliary Diesel Power on the Denver Zephyrs

By DAN WORTH, Locomotive Department, Cummins Engine Company



Four of the Cummins-G.E.C. auxiliary sets on test

THE consideration of the most suitable type of power for auxiliary purposes on the new 12-car Denver Zephyr and 7-car Twin Zephyr trains brought up many problems, such as economy of installation and operation, flexibility, assurance against power failure, weight of installation, simplicity of operation and other problems. Since the motive power on all the Zephyrs is provided by diesel engines, it was logical to consider only diesel engines for the auxiliary power. Certain features of the air-conditioning, power transmission, lighting, train-shed services and the like indicated that alternating current of standard characteristic (220 volts, three-phase, 60 cycles) would be the most satisfactory, and that practically all of the desirable features of installation, operation and standardisation could be met by a multiple-unit installation with units of approximately 50 kW. capacity.

Although the advantages of the multiple-unit power plant were fully recognised, there were still the problems of synchronising the alternators without the use of the complicated and expensive methods ordinarily employed, and the obtaining of engine governors with characteristics that would provide satisfactory parallel operation. It was further required that:—

1. The controls be arranged so that any combination of alternators might be operated in parallel.

2. The controls be arranged on the 7-car trains so that at least two alternators would be in operation and connected to the load before any of the air-conditioning compressors could be operated.

3. The controls be arranged on the 12-car trains so that at least three alternators would be in operation and connected to load, with at least two independently supplying power to the air-conditioning train line for compressor operation, and the third supplying power to the lighting train line.

4. Each generating unit be equipped with a 1·5 kW. d.c. Leece-Neville battery-charging generator driven from the engine, and voltage regulator for parallel operation in the charging of the 16-cell, 32-volt battery and supplying exciting current for the alternators.

5. Each train equipment be provided with a 5 kW. 32-volt battery-charging motor-generator set to operate from the 220-volt a.c. lighting circuit from either the diesel power or standby power furnished in the train sheds. This unit to work independently or in parallel with the Leece-Neville generators mounted on the engines, and to be arranged so that its operation could either be controlled by hand or be automatic to keep the batteries charged between predetermined limits.

6. A suitable signalling device be provided that would indicate to the driver that one or more of the alternator units had tripped off the line due to an overload, or had dropped in speed approximately 12 per cent. or more.

The driving power for each auxiliary set is a Cummins six-cylinder oil engine, and one of the illustrations shows four of these engines on the test bed at the works, together with their a.c. generators. The alternators and control equipment are of the G.E.C. type. The radiators, cooling fans, mufflers and practically all parts were assembled as nearly as possible to simulate the installation in the trains. The water-barrel rheostat (with parts of the three electrodes) can be seen in the background between the second and third engines. The units were set on the wood or concrete floor without any means of holding them rigidly to the flooring, and the smoothness of operation was evidenced by the lack of vibration despite the makeshift foundations. These factory tests were made in order to operate the engine-alternator units under full load conditions of engine and cooling system and to check the functioning of the various features of the control apparatus. The final tests were made when the units were connected and wired in the actual installation where the resistances, reactances and other conditions are more definitely fixed.

The third of the accompanying illustrations show the

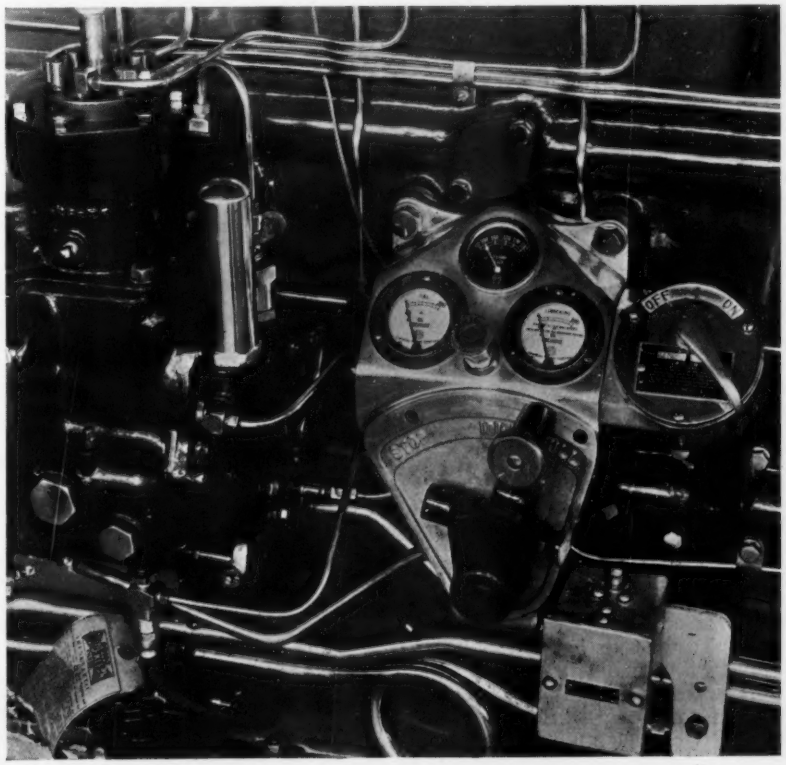
Illustration showing speed switch on the end of the alternator shaft

engine throttle control and instrument panel, containing a lubricating oil pressure gauge, fuel oil pressure gauge and a thermometer for indicating engine temperature. The two-stage starter control switch is shown on the right. The first position on the switch connects 6-8 volts (tapped from three cells of the battery) across the starter motor which is sufficient to engage the starter pinion with the flywheel ring-gear. The second position energises the magnetic starter contactor which connects the starter motor across the 32-volt battery and the engine is cranked for starting. This arrangement saves the mechanical-inertia starting gearing from extremely heavy impact stresses when engaging the starter pinion.

The governor throttle handle is shown between idling and full load positions. In the full load position the throttle latch drops into the right-hand hold on the throttle bracket, and the end of the set screw on the lever at the back of the throttle bracket closes the throttle switch. An adjusting thumb nut is shown on the right-hand side of the throttle lever providing micro-adjustment of the full load throttle setting.

The Cummins balanced and controlled fuel distribution system, in which one single-plunger fuel pump measures each charge of fuel to each cylinder under comparatively low pressures, provides a very sensitive reaction to governor speed regulation. Moreover since the fuel pump and governor, shown at the left side of the picture, are enclosed in the same oiltight housing, wear and lost motion are reduced to a minimum, and linkage friction is almost entirely eliminated. In order to obtain governors with the same regulation the springs and weights were selected from stock parts to very close tolerances. The 14 governors for the 14 plants supplied were built up on the bench, and when the engines were tested only one of the governors had to be readjusted. This fact indicates the sensitiveness and accurateness of the Cummins governing mechanism.

The problem of synchronising the alternators is accomplished by interlocking certain electrical functions with the throttle mechanism and the speed switch on the end of the alternator shaft, shown in the second illustration. The speed switches are adjusted to close an electrical circuit at approximately 1,170 r.p.m., which also opens the circuit when there is a drop in speed to about 1,060 r.p.m. This switch is electrically connected in series with the engine throttle switch, and necessitates the engine throttle being in the full-load position and that the alternator running at approximately 1,170 r.p.m. (synchronous speed 1,200 r.p.m.), before this control circuit is established. This



Engine throttle and instrument panel, containing the necessary gauges and temperature recorders, for the Cummins-G.E.C. auxiliary power sets of the 12-car 3,000 b.h.p. Winton-engined Denver Zephyr trains of the Chicago, Burlington & Quincy Railroad

circuit closes the three line contactors which connect the individual alternators to the line. When the line contactors close, an electrical interlock on these contactors establishes the control circuit for the contactor which supplies the alternator field from the storage battery and d.c. generator mounted on the engine.

Thus it is apparent that the alternator is very close to synchronous speed when it is connected to the power line, and as the rotating field builds up in strength the unit is pulled into phase and synchronous speed with the power that is connected to the line—which is usually being supplied by one or more of the other alternators. However, if an outside source of a.c. power is connected from a train shed connection, a phase rotation selector assures proper phase relations to prevent any damage.

The alternator fields are so designed that flux changes can take place promptly and in addition are provided with Amortesseur windings. The side bar connections of each pole-piece Amortesseur winding are bolted to the bars of the adjacent pole piece in order to facilitate removal of field coils or poles. The Amortesseur winding functions similarly to the squirrel cage motor winding of a polyphase induction motor and since the alternator is brought up to approximately synchronous speed by the engine before it can be connected to the line, the squirrel cage windings are functioning as motor windings for only a short time while the rotor field is building up. It would not be practical to attempt to start the diesel engine with these windings, on account of the low starting torque characteristics of squirrel-cage windings.

These factory tests were made primarily to obtain:—

(*a*) The final engine shop tests under full load operating conditions.

(*b*) The practicability of the system of synchronising the alternator when an additional unit is put on the line by one of the train crew.

(*c*) The primary functioning of all the various items of the control equipment.

The tests were highly satisfactory and were observed by the officials of the Burlington Railroad, who were responsible for the selection and operation of the Cummins equipment.

Operating Experiences with the Burlington Zephyr

CERTAIN details of the operating experience gained with the various stainless-steel Zephyr diesel-electric trains of the Chicago, Burlington & Quincey Railroad were given in a paper read recently before the American Society of Mechanical Engineers by Mr. E. F. Weber.

For the first 838,882 miles made by the first four trains up to March 1 last the availability was 97 per cent. Prior to inaugurating the Twin Zephyr service out of Chicago the personnel was given some training in maintenance and repair on the three oil-electric switching locomotives owned by the railroad, but it was obvious that with an organisation developed and equipped to care for steam locomotives it would not be possible to get 100 per cent. efficiency on the Twin Zephyr service, each rake in which was scheduled to cover 26,460 miles a month at an average of 66 m.p.h. Nevertheless the troubles which did occur were not serious.

With the original Zephyr some difficulty was occasioned with the fuel injectors of the Winton two-stroke engines, due to air leaks in the packing and connections which produced some irregularity in the pump, and resulted in air locks in the fuel pipes. This was corrected by putting in a return pipeline which kept the air moving and did not permit an air lock. Some slight difficulties were experienced also with pistons, valves, and cylinder heads. Despite the high pressures absolutely no trouble has been given by the crankshaft and big end bearings.

There were also four instances of trouble with the traction motors. One of these was due to improper lubrication, and resulted in a change in the practice regarding grease lubrication. Two were due to armature roller-bearing failures, and the fourth was due to a failure on the part of one of the maintenance staff. A field coil burned out in the main generator of the original Zephyr working between Kansas City and Lincoln when a flash-over was caused by snow getting into the generator. A side door of the engineroom came open and remained unnoticed for some little time and allowed snow to be blown in.

The Twin Zephyrs make 2·9 train miles per U.S. gallon of fuel when running as three-car trains. The four-car sets working on somewhat slower schedules make 2·4 and 1·9 train-miles per U.S. gallon respectively. In all cases the engine is of 660 b.h.p. The maintenance, fuel, and oil costs of the first four units for the first three-quarters of a million miles were as follows, the maintenance figure referring only to the power car, engine and auxiliaries, electrical equipment and transmission: maintenance 2·62 cents per train-mile; fuel 1·39 cents per train-mile; and lubricating oil 0·83 cent per train-mile; total 4·84 cents. [Say 2½d.]

Inspections of the diesel-electric trains can be made during lie-over periods. Moving parts of an oil engine are of a nature and weight which permit normal running repairs to be made during the same periods, if there are about seven hours at the shed between arrival and departure. This is not true of a steam engine. Assuming a trained personnel, proper facilities, an adequate stock of repair parts, including a spare power truck and some traction motors, it would seem that theoretically a diesel-electric train could be kept in road service constantly between heavy repairs. Removal of the oil engine crankshaft for regrinding is the outstanding work which will necessitate general repairs. The mileage before this is necessary should be 500,000 [with streamlined trains covering over 20,000 miles a month], but of course as a practical matter no such perfect availability can be obtained, because something will happen to prevent it.

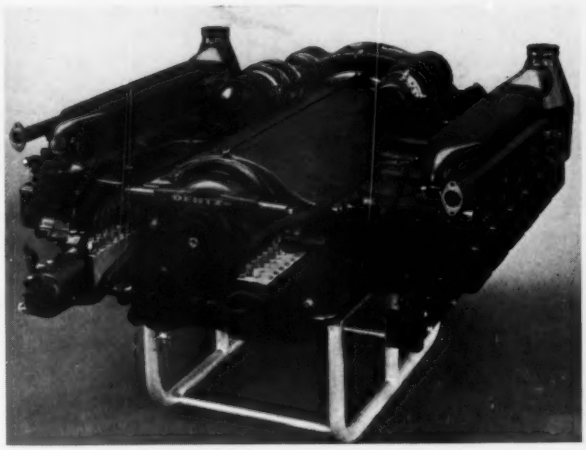
P.O.-MIDI RAILCARS.—The 12 Renault type ABJ railcars delivered to the P.O.-Midi Railway during recent months are arranged for multiple-unit working. They have the latest type of 300 b.h.p. 12-cylinder engine and a four-speed gearbox. They have 70 seats and 90 sq. ft. of luggage space within a length of 85 ft. and on a tare weight of 27 tonnes, and operate from the railcar centres at Tours and Bordeaux.

FRENCH STANDARD RAILCARS.—Eight of the 23 " standard " diesel-mechanical railcars (see issue of this Supplement for June 12, 1936) ordered by the Nord are in service and have covered an aggregate of 170,000 miles, of which 7,000 miles were with a 15-ton trailer and 10,000 miles with 30 tons of trailers. These cars now assure the fast Lille-Havre service which prior to October 4 was worked by the Nord 820 b.h.p. triple-car oil-electric trains. Six light trailers built for use with these vehicles are being put into service.

A GERMAN STANDARD HORIZONTAL ENGINE

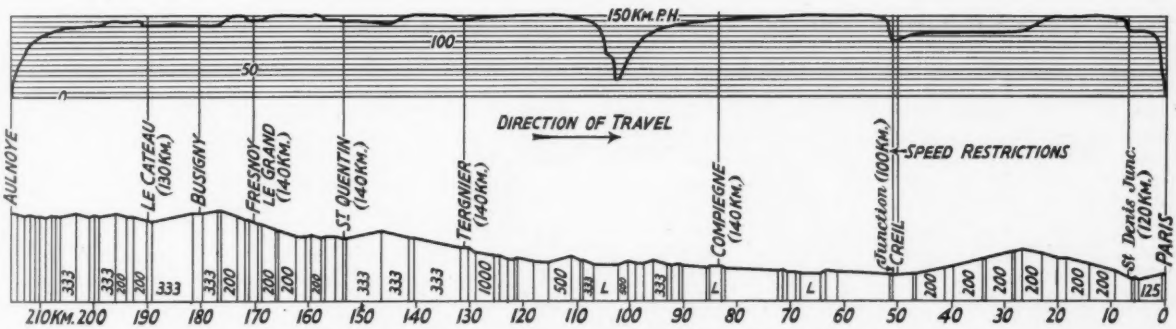
As a result of the experience gained on test and in service with the 180 b.h.p. horizontal oil engine built by Deutsche Werke Kiel (see issue of this Supplement for November 1, 1935), the German State Railway invited the collaboration of D.W.K. and other German manufacturers for the production of a more powerful engine of the same layout which could be built at various works, and thus further the aim of the Reichsbahn to foster the German oil engine industry generally.

The essential connections and main components of all makes are the same but the details vary between the engines now being constructed at the Deutz, D.W.K., Daimler, and M.A.N. works. The accompanying illustration and notes refer specifically to the Deutz engine, a 12-cylinder *vis-a-vis* unit with cylinders 130 mm. by 190 mm. (5·12 in. by 7·5 in.). The continuous output is 275 b.h.p. at 1,500 r.p.m., and the weight about 4,500 lb., corresponding to 16½ lb. per b.h.p. The cylinder heads are of cast iron, and contain pre-combustion chambers into which the fuel is introduced through Bosch nozzles from two six-ram Bosch pumps mounted at one end of the engine and driven direct by single gears from the ends of two camshafts. The central crankcase is of cast iron; it is divided by a vertical joint into two parts, one of which carries the seven bearings of the crankshaft; the other half is securely bolted to its fellow. The crankshaft is of chrome-molybdenum steel with bearing surfaces hardened on the Doppel-Duro system, and running in bearing shells lined with lead bronze. Balance weights are attached to prolongations of the crankwebs. The connecting rods are not articulated, two separate rods working on the same crankpin. The pistons are of KS aluminium alloy and carry one scraper and three pressure rings.



275 b.h.p. Deutz railcar engine; it is fitted with Bosch starting motor and dynamo

Diesel Train Activities, Northern Railway of France



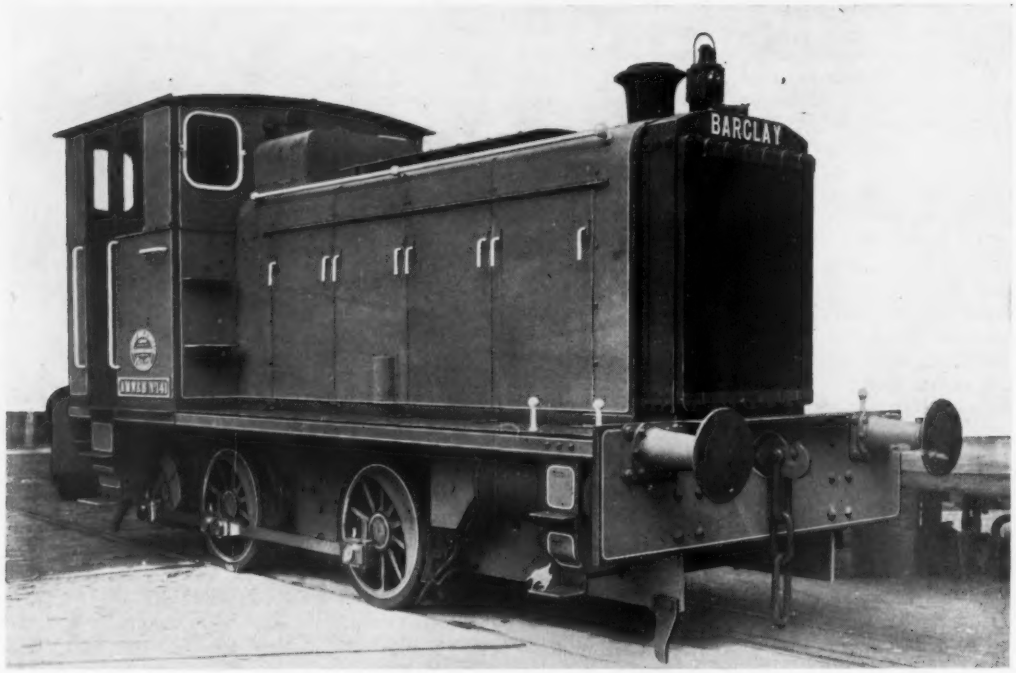
Speed diagram of special test run with Nord oil-electric train

Several developments have taken place recently in the operation of the three-car oil-electric trains of the Northern Railway of France. In the first place, they have been superseded on the Lille-Amiens-Rouen-Havre service by the so-called "standard" single-unit diesel-mechanical cars, and have been concentrated on the Paris-Lille and Paris-Aulnoye routes. Secondly, some of the Paris-Lille services have been accelerated to a time of 150 min. inclusive of three stops, for the 156 miles. On the down journey the 78·3 miles from the Gare du Nord to Longueau are scheduled in 65 min., a start-to-stop average of 72·3 m.p.h. This is the fastest booked run on the Nord and it constitutes a modification of the normal Paris—Lille diesel services, which normally run from Paris into Amiens without intermediate stop. The maximum permissible speed has been raised to 140 km.p.h. (87 m.p.h.) from the old limit of 120 km.p.h. (75 m.p.h.); on typical runs a top speed of 83-84 m.p.h. suffices, but speeds of 72-75 m.p.h. are maintained up the long 1 in 200 grades.

Preparatory to the inauguration of further services with these 820 b.h.p. Maybach-engined trains, a special test run was made last month between Aulnoye and Paris, and through the kindness of M. Lancrenon, Ingénieur en Chef du Matériel & Traction, we are able to publish a speed diagram of the trip. For this occasion the speed limit was fixed at 150 km.p.h. (93 m.p.h.). The distance of 134 miles was covered non-stop in 99½ min., at an average of 81 m.p.h. despite service slacks at various points to 87, 80, 75, and 62 m.p.h. and p.w. checks to 50 and 20 m.p.h. In the up direction this route has a general downward tendency, but on the 1 in 200 up grades between Creil and Paris a speed of 75 m.p.h. was maintained. Runs over this line to Liége have been made.

XUM

DIESEL-MECHANICAL LOCOMOTIVE FOR AIR MINISTRY

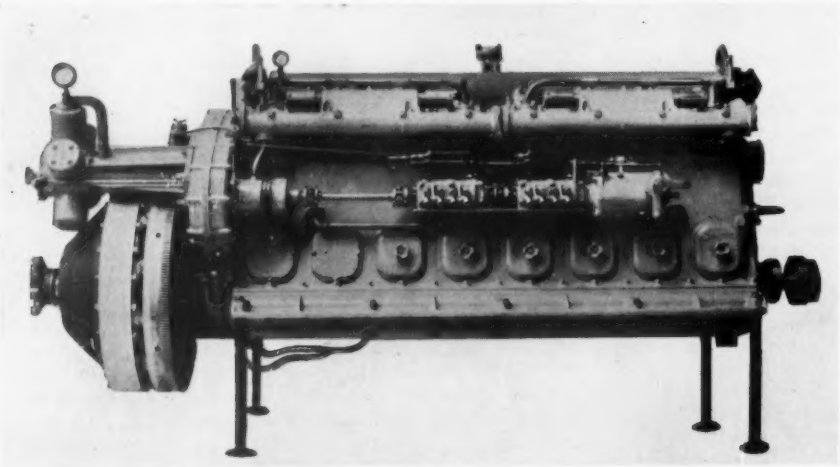


Barclay **160** *b.h.p. shunting locomotive*

THE Air Ministry has taken delivery of two diesel-mechanical locomotives built by Andrew Barclay, Sons & Co. Ltd. of Kilmarnock. The first was delivered in September of last year and has been in daily use and giving satisfactory service since; the second has been set to work recently. These units are of the **0-4-0** type, and are intended for shunting duties, and the speeds provided by the three-speed Wilson gearbox have been chosen with this in view. The gearbox ratios are **3·07 : 1**; **1·58 : 1**; and **1·0 : 1**, giving speeds of approximately **4**, **8**, and **12** m.p.h. The locomotives have a tractive effort of **11,000** lb. at **4** m.p.h., and **4,000** lb. at **12** m.p.h. The wheels are of **3** ft. diameter and are spread over a base of **6** ft.; the overall length of the locomotive is **23** ft. **5** in. and the weight in working order **22¾** tons.

The engine fitted to these locomotives is of the Gleniffer eight-cylinder type developing **160** b.h.p. at **900** r.p.m. This engine is based on the makers' well-known marine type, and has cylinders **6** in. bore by **7** in. stroke; on the continuous rating the brake m.e.p. is **89** lb. per sq. in. and the piston speed **1,050** ft. per min. It is mounted on a substantial sub-frame within the main frame of the locomotive. This engine was described and illustrated in the issue of this Supplement for July **10**, **1936**. The Gleniffer engine has a low idling speed and this, combined with unusual flexibility, makes it ideal for use in a shunting locomotive.

The transmission is arranged as follows. A Vulcan-Sinclair traction type hydraulic coupling is mounted on the flywheel of the engine. This is followed by a flexible



160 *b.h.p. Gleniffer eight-cylinder oil engine and Vulcan-Sinclair fluid coupling as used in the Barclay shunting locomotive*

coupling of the Simms-Jurid type, which transmits the drive to a Wilson three-speed epicyclic gearbox. This gearbox is built in unit form with a Bostock & Bramley reverse gear and final drive, the final drive being of the enveloping worm type. The worm wheel is mounted on a jackshaft from which the drive is taken by means of cranks and connecting rods to the wheels, which are coupled by rods. All shafts of the transmission are mounted on ball or roller bearings.

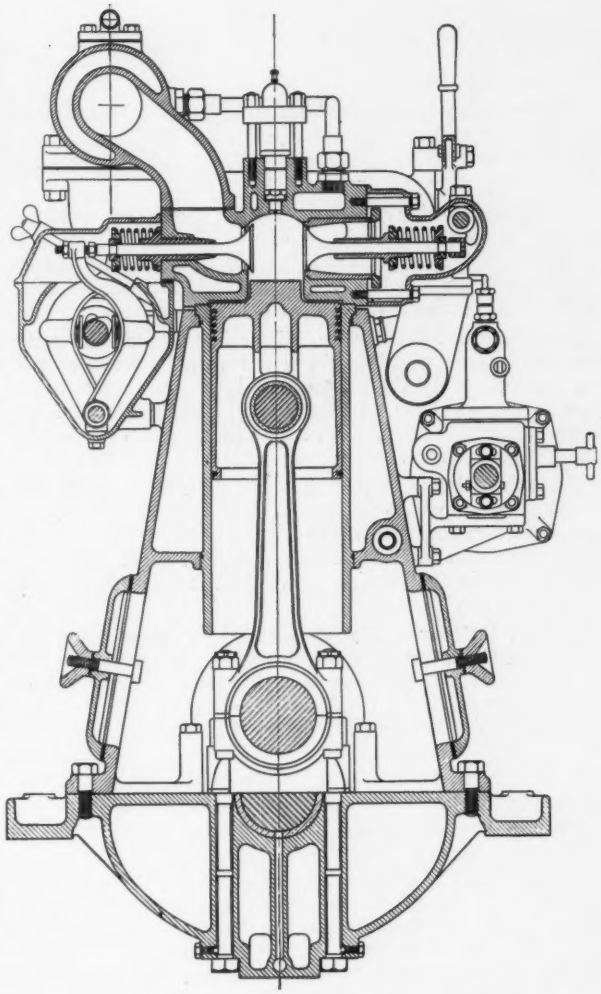
The gearbox and the reverse gear are operated by compressed air. They are each controlled by a single lever with an interlock to prevent the use of the reversing control, except when the gearbox is in neutral. These levers are small and light to operate, and the combination of the hydraulic coupling and Wilson gearbox makes gear-changing particularly simple, the drive being taken up progressively on any gear without shock or jar. This is noticeable when starting with a heavy load.

Mechanical Portion Details

The locomotives are fitted with a roomy cab, in which the controls are duplicated, enabling the driver to operate the locomotive from a seat on either side. The controls have been reduced to a minimum and are simple in use. The engine is controlled by means of a single lever, in much the same way as the regulator handle of a steam locomotive. The locomotives are fitted with Westinghouse compressed air brake gear, air at 80 lb. pressure being provided by two double-cylinder compressors belt-driven from the engine crankshaft. A single lever controls the Westinghouse brakes by means of the latest type of self-lapping brake valve. The air for the gearbox control is also taken from this source through a reducing valve, which reduces the pressure to 60 lb.

The radiator is of the Reliance sectional type, and is of large dimensions to give an ample margin of cooling capacity, and a feature is a large make-up water tank. The engine is started by compressed air by means of an air motor and Bendix gear. Air for starting is obtained normally from a small compressor, belt driven from the transmission shaft, but it can also be obtained from one of the engine cylinders. It is stored in the cylinders at 300 lb. per sq. in. pressure. A Ruston petrol-driven compressor set is housed in one corner of the cab and is also available for charging, while a further safeguard is the provision of a hand pump.

An electric cab lamp is fitted, also two electric lamps under the engine casing. These are supplied from a storage battery. A window is provided between the cab and the engine casing to enable the driver to see into the casing. The cab is fitted with teak doors with locks and sliding windows, enabling it to be completely closed in bad weather or when the locomotive is out of use.



Cross section through Gleniffer engine

British Cars for South America

THE first of the 11 diesel-mechanical railcars ordered from the Birmingham Railway Carriage & Wagon Co. Ltd. in 1934 by the Entre Rios Railway has been completed. Power is derived from two Gardner 5L3 engines developing a maximum of 127 b.h.p. at 1,200 r.p.m., and driving through Vulcan-Sinclair fluid couplings and four-speed Wilson epicyclic gearboxes with electro-pneumatic control. To the 3 ft. wheels are bolted inside brake drums, and Girling brake equipment is used. The passenger portion is divided into first and second class saloons seating 18 and 36 persons respectively. Stone's pressure-ventilating system is incorporated, and the inside surface of the aluminium side panels is sprayed with asbestos insulation against heat and noise. Buffet and lavatory accommodation is provided. The body framing is fabricated of U-shaped steel sections, and welding has been adopted in the construction of the bogie frames. The cars are 71 ft. long overall and tare 28·95 tons, made up of 7·3 tons for two bogies; 13·35 tons for the body and underframes; and 8·3 tons for the power equipment. With a full complement of passengers and supplies the weight is 33·75 tons. The maximum speed is 65 m.p.h.

SPECIAL TRIPS BY DIESEL.—On the Alsace-Lorraine Railways diesel cars are being used to an increasing extent for special parties. In 1935, there were 28 journeys totalling 4,058 km. (2,520 miles), but during the first six months of 1936, diesel cars made 85 special trips totalling 10,938 km. (6,800 miles).

RAILCARS WITH SUPERCHARGED ENGINES.—The P.L.M. Railway is now taking delivery of eleven Somua railcars powered by M.A.N.-type engines built under licence in France by the Soc. Générale de Constructions Mécaniques. The cars have eight-cylinder 280 b.h.p. engines, but in the last three cars the engines are fitted with Rateau turbo-blowers raising the output to 350 b.h.p. These cars are fitted with Somua mechanical transmission.

NOTES AND NEWS

Government Locomotives.—The War Department has ordered two diesel-mechanical shunting locomotives from Andrew Barclay & Sons Ltd. They are to be powered by 150 b.h.p. Gardner engines.

Canadian Railcar Mileage.—The aggregate mileage of the 28 oil-electric railcars of the Canadian National Railways to the end of 1936 was 10,275,000. One of the first Beardmore 200 b.h.p. cars had 560,608 miles to its credit on December 1 last.

New Zealand Extension.—The New Zealand Government Railways are building in their own shops the mechanical portions of 12 double-bogie railcars which are to be powered by Leyland oil engines and fitted with Leyland hydraulic transmission. Each car will have two 130 b.h.p. six-cylinder engines.

Cars for Lithuania.—The Lithuanian State Railways have on order four double-bogie double-engined 440 b.h.p. diesel railcars and one spare power bogie. The engines being fitted are of the 220 b.h.p. M.A.N. type, and they will operate in conjunction with Mylius mechanical transmission.

B.A.P. Railcars.—For installation in three of the six 240 b.h.p. Ganz cars ordered by the Buenos Ayres Pacific Railway about three months ago, three sets of Voith-Sinclair hydraulic transmission are to be supplied by the Hydraulic Coupling & Engineering Co. Ltd., of Isleworth. These turbo transmissions will be required to transmit continuously 210 h.p. at an engine speed of 1,170 r.p.m. plus 25 h.p. for auxiliary drives.

Mylius Transmission.—Included in the 677 sets of Mylius mechanical transmission now in service or on order are 107 for the German State Railways, 130 on German private railways, 89 on the Roumanian State Railways, 55 on the French State Railways, and 46 in Poland. This gear drive is to be used in conjunction with the new CLM-Junkers two-stroke opposed-piston engines of 250 b.h.p. now being installed in French railcars.

Cuban Conversion.—The United Fruit Company has recently acquired for its lines in Cuba an oil-engined railcar rebuilt from a 190 b.h.p. petrol-engined car which had been in service for several years on a railroad in the United States. The new oil engine is of the Cummins HB-6 type developing 150 b.h.p. at 1,800 r.p.m., and driving a five-speed mechanical transmission. The railcar weighs 27 tons and hauls a 22-ton trailer, when required, up a 1 in 66 grade at 15 m.p.h.

Algerian Progress.—Following experience with four 100 b.h.p. Panhard-engined metre-gauge diesel cars taring 9 tons and seating 33 passengers, the Algerian Railways have ordered three Renault double-bogie cars for the standard-gauge lines, which are to have 300 b.h.p. engines and seats for about 80 passengers. The two diesel-electric locomotives set to work in 1933 on the Algiers-Blida and Algiers-Oran routes are still giving good service, the 750 b.h.p. Sulzer-engined locomotive being engaged in light goods traffic, and the 920 b.h.p. M.A.N.-engined locomotive on light fast passenger trains.

Another Irish Diesel.—The Northern Counties Committee of the L.M.S.R. is building in its York Road shops a third double-bogie diesel railcar of the same general type as that set to work last summer and described in the issue of this Supplement for August 7, 1936. It will be fitted with two 130 b.h.p. Leyland oil engines and hydraulic transmission, and will have the end conning tower drive favoured on this railway. A second free wheel is to be incorporated, on the direct drive, so that the car may coast either in fluid or direct drive and in either direction. In the previous cars a free-wheel was fitted only on the torque converter. The cooling of the engine lubricating oil is to be effected in a small radiator mounted beneath the underframe, through which the oil will be forced by means of a small pump. This arrangement supersedes sump cooling.

Still More Cars for Argentina.—The Argentine North Eastern Railway has ordered seven light railcars and the Entre Rios Railway one from the Drewry Car Co. Ltd. The power and transmission units will be the same as those specified for the 99 cars ordered by the Buenos Ayres Great Southern Railway at the end of last year, viz., 100 b.h.p. Gardner 6LW engine, Wilson epicyclic gearbox, Vulcan-Sinclair fluid coupling, and Drewry power bogie. The cars will seat 40 passengers and carry about 2 tons of luggage within a length of 47 ft. 6 in. and on an estimated tare weight of 20½ tons. Incidentally, the Drewry Car Company also has received an order from the B.A.G.S. Railway for one complete power bogie to be used as a spare in connection with the 99 railcars ordered for service on that line and the associated Buenos Ayres Great Western Railway.

New Petter Engine.—Embodying the well-known suction principle called here "harmonic induction," a new range of two-stroke oil engines has been designed by Petters Limited, of Yeovil, and the range is stated to be suitable for locomotive purposes. Engines with 1, 2, 4, 6 and 8 cylinders are available, the output being 16 b.h.p. per cylinder at 1,000 r.p.m. By means of the harmonic induction principle the fresh air required to recharge the cylinder is drawn or sucked in by means of the vacuum which is produced as a result of the wave motion in the exhaust pipe. Blowers, auxiliary compressors, and other outside methods of charging thus are eliminated. It is claimed that better scavenging is obtained and a 50 per cent. greater output developed than with normal two-stroke engines, but nevertheless we believe that the rated brake m.e.p. is only 62 lb. per sq. in.

Italian Railcar Progress.—A great extension of diesel traction is taking place on the standard-gauge lines of the Italian State Railways. An order for 80 double-engined bogie railcars has been placed with the Soc. Italiana Ernesto Breda, of Milan; the cars themselves will be virtual duplicates of the vehicles built in 1934 and described in detail in the issue of this Supplement for March 22 of that year. Each bogie will carry a 130 b.h.p. A.E.C. engine, a four-speed Wilson epicyclic gearbox, and a Vulcan-Sinclair fluid coupling, but all these power and transmission components are to be built under licence by Breda. The 1935 cars weigh 20 tons and seat 56 passengers. They are used for solo operation and on test one of them attained a speed of 100 m.p.h.

The Italian State Railways have also ordered three double-bogie standard-gauge cars from the Soc. Ansaldo, of Genoa. Each car is to have two 130 b.h.p. engines and two sets of Mylius mechanical transmission. As from January 1 last, diesel railcars have replaced the whole steam service on the Trieste-Pola, Divaccia-Espelle, and Rovigo-Chioggia routes, and since January 18, the Milan-Venice diesel services have been extended westwards to begin and end at Turin, with an end-to-end time of 4 hr. 20 min.